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CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—

The Thirty-first Annual Meeting of the New England Association of Gas Engineers 41

Instituting "Wrinkle" and "Novelty Advertising" Departments, Ohio Gas Light Association 41

EDITORIALS—

Briefly Told 41

A Resignation and a Resolution—The "Tranactions" of the Incorporated Gas Institute for 1900—Notes

The Working of Regenerator Furnaces, by Mr. S. B. Chandley 42

A Court Decision as to the Responsibility for Damage by Electrolysis to Gas Mains 45

Uniform Municipal Accounting 46

Electric Lights Along the Coast, by Mr. G. E. Walsh 46

The Future of the Gas Profession—No. III 47

Industrial Policy and Foreign Competition 48

Coal in 1900 50

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 52

Mr. O. M. Diall Takes Charge at Macon, Ga.—Cheaper Gas for Danvers, Mass.—An Odd Message by a Suicide—Consolidation at Mason City, Iowa—Death of Mr. Clarkson Cates—Annual Meeting, New Haven (Conn.) Gas Light Company—Resignation of Mr. G. W. Elliott—The Gowanus Canal and the Brooklyn Union Gas Company—The "Donnelly" Bill—Mr. Swain Goes to Kankakee, Ills.—The Ossining Heat, Light and Power Company—Death of Mr. James C. Gilbert—Facts from Supt. Knowles' Report—Cheaper Gas for Memphis, Tenn.—Something from Eau Claire, Wis.—Gas Facts from Kansas City, Mo.—And Other Items.

The Market for Gas Securities 55

[OFFICIAL NOTICE.]

THE THIRTY-FIRST ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Jan. 8, 1901.

The thirty-first annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, Mass, February 19th and 20th, 1901. N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

Instituting "Wrinkle" and "Novelty Advertising" Departments, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
DELAWARE, O., Dec. 7, 1900.

For the seventeenth annual meeting of the Ohio Gas Light Association, which is to be held in Dayton, O., March 20th and 21st, 1901, the Executive Committee has created two new features, viz.: A Wrinkle department, for which Mr. Henry L. Doherty, President Denver Gas and Electric Company, Denver, Col., has been named as Editor; and a Novelty Advertising department, which will have for its Manager, Mr. B. W. Perkins, Superintendent South Bend Fuel and Gas Company, South Bend, Ind.

These departments should prove very attractive for the meeting. Their success, however, depends largely upon the active co-operation of the members. It is, therefore, earnestly hoped that the fraternity will not be backward in sending Wrinkles to Mr. Doherty and "Advertising Schemes" to Mr. Perkins. T. C. JONES, Secretary.

BRIEFLY TOLD.

A RESIGNATION AND A RESOLUTION.—Some time ago Captain W. H. White, who, as our readers well know, has for a lengthly period efficiently and faithfully represented the Western Gas Construction Company, of Fort Wayne, Ind., as its Eastern representative, resident-engineer, was forced to the conclusion that the duties imposed upon by such representation conflicted too much with his wish to work on independent lines. After due consideration of the matter between the interested parties the Company finally accepted Captain White's resignation, and in formally recognizing it adopted the following minute, at a meeting of the Board, held in Fort Wayne the 3d inst.:

"*Resolved*, That the resignation of Captain W. H. White from the Directorate of the Company, and from its active representation in New York, be, and the same is, hereby accepted. That the Board in this action is governed solely by the wish of Captain White to be relieved from the duties which he has exercised with entire acceptability to this Company from his first connection with it. That the Board records its great regret at the severance of the relations which have existed for over 6 years, and have been marked with a uniform and enthusiastic zeal for the Company's welfare on the part of Captain White, and with pleasure to the members of this Board, who have all served continuously thereon with him during that period; and that the Secretary be instructed to transmit to him a copy of this resolution."

From this reported action, which must be accepted as true on its face and in its wording, it is not to be inferred that Captain White has any

intention of ceasing the active pursuit of the profession with which he has been cleverly connected since 1866. The Western Gas Construction Company, at least so far as we know, has not yet selected a successor to Captain White in the instance of its Eastern representation.

THE "TRANSACTIONS" OF THE INCORPORATED GAS INSTITUTE FOR 1900.—We are indebted to the courtesy of Mr. Walter T. Dunn, working Secretary of "The Incorporated Gas Institute" of England, for a copy of its "Transactions" for the year recently closed. The volume, and a well gotten up and arranged one it is, contains a complete report of the Institute's 37th annual meeting (held in London last June), together with an excellent summary of the proceedings had at the International Gas Congress (Paris, 3d to 6th September) during the "Exposition Universelle." The letterpress, engravings and binding are of the best order, and Secretary Dunn should be congratulated upon the appearance, effect and value of the work, which evidently cost him many week's of persistent labor.

NOTES.—Mr. Franklin D. Moses, "the Man from Trenton," has been deputed by the Consolidated Gas Company, of Baltimore, Md., to prove to its customers in a practical way the benefits of gas as a fuel. This looks to be in line with the idea which prompted Mr. Charles H. Dickey to take a try at bettering the output of the Company, and the Company in our belief made no mistake when it named the man from Trenton as a likely one to lead it out of the wilderness it made for itself by neglecting to carefully and positively advocate the use of gas in the households of one of the handsomest cities of America. It may be taken for granted that the number of gas stoves put out in Baltimore this year will reach very near to five figures when the totals are footed. ——The proprietors of the New Haven (Conn.) Gas Company have put their net selling rate at $1 per 1,000 cubic feet—this figure rules for all purposes. We wonder if there is any smiling going on in Hartford? ——A right enjoyable gathering was on at the banquet given by the H. Mueller Manufacturing Company, of Decatur, Ills., to its employees, the night of December 31st. The banquet hall was the St. Nicholas Hotel, and the tables, according to the hotel man's count or round-up, afforded room and sustenance for and to no less than 135 of the Company's force. We said it was a banquet to the employees, but we should have said that the "bosses" as well as the "bossed" took a practical part in the proceedings that drowned the old year and that baptized the new one. Mr. Adolph Mueller, Secretary and Treasurer of the Company, acted as Toastmaster, and a good one he made. Mr. Phillip Mueller, the Company's Superintendent, delivered about the heartiest speech of the evening; but likely the most fun was brought out by a New Yorker (Mr. Murray Milliken, of New York), whose rattling response to the toast of "Our Ladies; God Bless 'Em," caused him to be very much liked in Decatur.——Governor Odell has named the following to compose the New York Assembly Committee on Gas, Water and Electricity: Messrs. Rogers, of Broome; Fordyce, of Cayuga; Henry, of New York; Ellis, of Genessee; Gardner, of Monroe; McMillin, of Schenectady; Waite, of Kings; Platt, of Steuben; Hanford, of Tioga; Brooks, of Erie; Kelly, of Albany; McKeown, of Kings; Sullivan, of New York.——Other reminders of the New Year recently at hand are handsome calendars from the United Gas Improvement Company, and the Davis & Farnum Manufacturing Company. ——The American Bridge Company announces the following appointments: Mr. E. W. Stearns has been appointed Manager of the East Berlin (Conn.) plant. Mr. Frank S. Moore assumes the management of the Lafayette (Ind.) plant, and all the Pittsburg plants have been incorporated into one, the same to be under the direction of Mr. J. W. Walker. Mr. C. A. Billings having been appointed Assistant Treasurer for the New York district, Mr. H. W. Post has been appointed Manager of the Post & McCord plant.——The following interesting lines are from the New York *Sun*, of Thursday last: "Peter Jaubert, a restaurant keeper at 132 East 59th street, asked Justice Blanchard yesterday for a mandatory injunction requiring the Consolidated Gas Company, which has cut off his gas, to restore it and charge him only 65 cents. He says he made a contract with the New Amsterdam Company at 61 cents while the gas war was on and that he changed to the Consolidated on agreement to give him gas for 1 month free and for a year ending May 18 next, at 65 cents. He admits he got gas for a month free. The defendant set up that the agreement was to give 1 month free and that he was thereafter to pay the established rate. When gas was raised to $1.05 last July he would not pay at that rate, and when his bill was $68 the Company cut off his gas. Justice Blanchard refused an injunction, saying that if Jaubert has the contract he has a remedy at law."

The Working of Regenerator Furnaces.

[A paper read by MR. S. B. CHANDLEY, of Warrington, England, at the last meeting of the Manchester and District Junior Gas Association.]

Perhaps there is not a more important feature in the working results of a gas undertaking than the heating of the retort settings. It has often been said that the money of a gas company is either made or lost in the retort house. In Newbigging's "Handbook," one of the "Golden Rules" set forward is "Keep up the heat of the retorts." It becomes the duty of the gas engineer to adopt a system which will keep his retorts at the best heat for the production of gas, combined with the greatest economy of fuel and labor.

As you are all aware, the heating of furnaces by generator gas, with or without heated air supplies, is acknowledged to be the system of the day which has unquestionably the greatest economical advantages of any process for the generation and utilization of heat. All the principal gas works now being erected or in course of reconstruction adopt one or more of the many patterns of generative or regenerative retort settings now before the profession; and the complex question of which is the best or most suited to the special cases has to be gone through, and a final selection made. Although the title of this paper is "The Working of Regenerative Settings," I find it very necessary to dwell on the construction and general arrangement, as well as the working; for not without a thorough knowledge of the former can the latter be obtained.

In most of our English regenerative settings, there is a gas producer to each bed of retorts—in fact, it generally forms part and parcel of the setting which it is called upon to heat. This, however, is by no means always the case. It is not at all infrequent to find one producer working two or more beds of retorts which may be some distance from the gas producer; and in some cases the retort settings are heated from gas producers placed outside the retort house altogether, at a distance of as much as 50 yards—the producer gases being conducted to the settings by means of cast iron flues with fire brick linings. There is, of course, loss from radiation when the generator or producer is away from the setting; but although this is said to be small, the practice of placing the producer away from the setting does not seem to have found favor among the gas engineers of this country.

The systems of regeneration are many; and it would be quite impossible to go into the details necessary to examine them in this short paper. Siemens in his original system passed the waste gases from the furnace through chambers of checkered brickwork for a given time; heating the brickwork to a high temperature. The direction of the waste gases was then reversed, and the secondary air supply passed through the brickwork to absorb the heat which had been previously imparted to it by the waste gases. This intermittent system gave very excellent results, but has a great disadvantage in requiring the direction of the waste gases to be changed periodically, which involves a certain amount of complicated machinery. Siemens's systems of heating in the various manufacturing industries of the world are very extensively applied, perhaps more so in the iron smelting processes than any other. Twenty years ago there were about 10,000 Siemens furnaces in operation; and since then the number must have increased many times.

The function of a gas generator or producer is the conversion of a carbonaceous fuel into a combustible gas composed mainly of carbon monoxide, instead of by direct combustion into carbon dioxide. In ordinary working, without generators, a very large quantity of air is drawn into the retort setting in excess of what is necessary for its proper working, and hence a loss of heat by its being withdrawn with the large quantity of waste gases. With a gas producer, this is not the case, as the exact amount of air required can be added to a nicety.

The usual system of regeneration is by sandwiching the waste gases with the secondary air supplies; the latter obtaining their heat from the former by radiation through the intervening material. This material is generally brickwork. Iron pipes are sometimes used; but although the amount of heat which will radiate through iron is forty times greater than the same thickness of brickwork, it is seldom used on account of the rapidity with which it burns away. Regeneration is understood to mean the transferring of the heat from the waste gases to the air required for burning the gas from the producer. This, in many cases, is heated to 1,000° F., and the waste gases leave the setting at 600° F.

Although the advantages of gaseous firing are unanimously acknowledged, this is not the case with respect to regenerative firing.

Competent authorities contend that the extra cost of settings with the regenerating arrangements is not compensated for by the saving in fuel which they accomplish. This is no doubt perfectly true in respect to the more complicated systems, where a very heavy capital expenditure is involved; but it can hardly be the case with the less elaborately constructed settings, and the usual estimate of economy is 20 per cent.

Mr. C. C. Carpenter, now Chief Engineer to the South Metropolitan Gas Company, in a paper on the subject, said he found no great advantage in regeneration over generation; and in an arrangement by which he could bye-pass the regenerating portion of his settings, he only obtained a reduction of 1 pound per 100 pounds of fuel used, by regenerating the secondary air supply of the furnace. The same authority contends that the working of several settings from one generator is the method to be preferred above others; and the results obtained by him certainly justify his remarks.

Principle of Regenerative Firing.—The principle upon which regenerative firing is worked is as follows: Primary air enters the furnace, and on reaching the red hot fuel at the bottom combines with it and forms carbon dioxide (CO_2). This goes through a further quantity of fuel, and combines with another atom of carbon, and becomes carbon monoxide (C_2O_2 or CO). The producer gas issues through the nostrils of the producer into the combustion chamber, where it meets the secondary air supply necessary for its combustion, and then finds its way into the setting, and after heating the retorts therein makes its way into the main flue, heating the secondary air supply on its exit.

Advantages of Gaseous Firing.—The advantages claimed for gaseous firing are well known to you all. Perhaps, however, it will not be out of place to mention them here. The most important is the saving of 50 per cent. of the fuel used, which includes the saving by firing with red hot coke direct from the retorts. This might, of course, be done in direct fired furnaces to a certain extent, by having them specially constructed for the purpose. I have never seen any which permit of this being done, but know of no reason why it should not be so.

Temperature of Setting.—Another important factor is the uniformity and certainty with which the temperature of the setting can be maintained. Any desired heat can be obtained in a properly designed setting. In most cases, simply regulating the primary and secondary air supplies will do this.

Clinkering.—Again, the laborious process of clinkering is reduced to a minimum, and the process does not admit large quantities of cold air into the setting, as is the case with direct fired furnaces.

Durability of Retorts.—The durability of the retorts is of no mean importance, and should certainly be mentioned in connection with the advantages of gaseous firing.

Other Advantages.—Cleanliness of retort house; handling of coke; and many other advantages will strike those who have had both systems in use as certainly worthy of mention.

[The author next proceeded to describe, by means of a diagram, an improved form of Klönne's regenerative retort setting which is, at the present time, in use at a number of places, including Warrington.]

Construction of Setting.—And now a few words on the construction of the setting. It is, of course, absolutely essential that the whole of the materials used in the construction of the stack and the lower portions of the settings be the best of their respective kinds. It is false economy to use inferior material, though lower in price, for this part of the work, as it would probably last 15 to 20 years if properly put up, and of good material to start with, and will in this instance fully repay any extra expense which may have been necessitated by superior quality of workmanship and material. In the case of the upper portion of the setting, containing the retorts, the material is not quite of the same importance, as they will require renewing every 2 or 3 years. This makes the use of high class materials not quite so imperative.

Labor.—Material, however good, is useless in the hands of unskilled labor; and it is only by the most careful supervision that the best work can be obtained. There is a great temptation, even among good class men, to get through work and make an external show. I say "external," because, when looked into closely, it often proves to be simply a mass of brickwork thrown together, not built.

Ordinary and Fireclay Work.—Building fireclay work is not like ordinary bricklaying, where a joint may be ¼ inch to 1 inch in thickness without any very serious results. Firebrick should be laid with only a skimming of finely ground fireclay; the brickwork being brick and brick well bedded with a mallet. In filling in spaces, the firebricks should be cut to fit the places where they have to go, and not small bits put in and flushed up with fireclay. Ordinary brick setters, used to outside work, can hardly be expected to change their usual mode of working, and use the care and skill necessary for building retort settings.

Turning Arches.—In the turning of the arches of the stack, particular attention is necessary to insure good work, especially if there is not much rise in the arch. The fireclay drops out of large joints, the key for the bricks is lost, and the arch gives way on the top of the retorts in the setting, causing them to be pushed out of shape; and no end of trouble is involved.

Gauging Bricks.—In turning arches of any importance, the bricks should be carefully gauged, and any which are not a good shape rejected. The remainder should be sorted out, and put in heaps of their respective kinds, and one course lengthways run with one shape, and then another course of another shape, and so on till the whole are used up. In this way, a good job may be made from bricks not actually uniform.

Combustion Chamber.—It is necessary to use special silica material in the combustion chamber, to withstand the high local temperature which is produced there. It is only by using material of a highly refractory nature that the fusion of the combustion chambers can be prevented.

Shields.—The special silica material is also used for shields, to prevent the direct action of the heat on the two outside middle retorts.

Division Walls.—Another point requiring consideration is the 4½-inch wall between the waste gas flues and the secondary air supply. If not perfectly built, and any cracks are left between the two flues, short circuiting would be the result; and the arrangement of dampers, etc., would be upset in consequence. To prevent this, the division wall is sometimes built with tongued and grooved bricks; and this certainly minimizes the risk of short circuiting.

Carbon Recuperation.—At this point, I might mention a comparatively new process of recuperation, in which a portion of the waste gases (say, 20 per cent.) is returned under the producer. This was described in a paper read before the Institution of Gas Engineers last year, and called "carbon recuperation." The system combines recuperation of the carbon from the waste gases and the heating of the secondary air supply. It has no advantages from a theoretical point of view; but it has been found conducive to economy by reducing the amount of carbon dioxide to carbon monoxide. An amount of heat is absorbed by this; but as the waste gases are drawn in hot, the balance of heat is about equal. Steam in this system is absolutely necessary, as great heat is produced just above the fire bars, which would quickly burn away without the influence of the steam to keep them cool. I mention this process of carbon recuperation so that it may be distinctly understood that the waste gases returned to the setting are returned under the fire bars of the producer, and not into the secondary air supply, which would take them direct to the combustion chamber, where the carbonic acid would be determined.

Cost of Setting.—One objection to the setting I have described is its high structural cost, which the number of special bricks necessitate—some of which cost 7s. 6d. to 8s. each. But as all the expense is in the lower portions of the settings (the top part being of ordinary bricks), the first impression of excessive capital expenditure is somewhat removed when it is remembered the length of time they will be in use. Many settings are in existence which are considerably less expensive in their first cost, and are composed of ordinary bricks; but they cannot be so durable, and are not so complete in their regeneration of the secondary air supplies. In the working of regenerative systems of heating retorts, there are many points requiring attention to insure good results.

Fuel.—This should be supplied red hot direct from the retorts into the producer. It should also be as uniform in quality as possible—that is to say, fuel having the same quantity of ash in it—as the amount of draught required to burn fuel with 7 per cent. of ash is not the same as that for fuel with 25 per cent. of ash, contained in (say) cannel coke. Some classes of fuel are productive of much trouble, not only in the amount of clinker formed, but also owing to the soft stickiness of some clinkers preventing their being removed in a satisfactory manner. Experience only can determine which fuels are free from this objectionable property, as the quantity of ash alone will not furnish a sufficient indication of its clinker forming capacity.

Keeping Furnaces Full.—It is of the utmost importance that the furnace be kept full of coke. If allowed to get low, the producer gas may burn in the producer and melt down the nostrils, which are not composed of silica material, and were never intended to be put to such a test. The producer must be filled at regular intervals, as the consumption of fuel may require.

Dampers.—The dampers should be regulated to give rather more than sufficient draught to work the setting when first starting, as this will gradually diminish as the flues become made up with deposits of soot and dirt, which become a serious obstruction in course of time, and have to be removed from the various passages by scraping, through the boxes provided for the purpose. The two dampers on each side of the setting should be so regulated that the heat is evenly distributed over the whole of the setting. The amount of heat may be increased or diminished by opening or closing the supply of air to the producer on the primary air doors of the furnace.

Nostril Bricks.—In many forms of setting, the nostril holes on the top of the producer require closing in the center of the setting, and gradually increased in area towards the front of the setting. This may be done by placing bricks partially over the holes; thus throwing the heat more to the front of the setting, which is generally cooler. The dampers, when once regulated, should be pointed up or fastened in some way to prevent them being tampered with. Nothing is more detrimental to the working of the regular heats than the constant altering of the dampers. As I mentioned before, the amount of heat should be regulated by the quantity of the primary air admitted ; thus burning a larger or smaller amount of fuel, as the case may be.

Secondary Air.—The secondary air supply requires careful adjusting. If too much is added, the excess cools the setting very considerably. If an insufficient quantity is added, the carbon monoxide burns in the flues or escapes up the chimney shaft, and is wasted. Just sufficient secondary air should be added to burn the whole of the producer gas formed, and no more. Experiment and inspection, or still better chemical analysis of the spent gases, will be the guide as to when the right quantity of secondary air is being admitted. If the secondary air supply is shut off altogether, a blue flame of carbonic acid will be seen burning in the waste gas flues, and they rapidly become heated. Now gradually open the secondary air supply ; and it becomes less until it disappears, and the flue will keep losing its heat till it becomes black, as excess of secondary air is added.

Excess of Secondary Air.—It is quite a mistake to think that when the waste gas flues are black there is no waste going on, and that the whole of the heat is being absorbed by the setting. Nothing is easier than to add an excess of secondary air to the setting and have all the waste gas flues cool. But this is not economy ; and the air over and above what is necessary to burn the producer gas to carbonic acid is simply cooling the setting.

Insufficient Secondary Air.—A blue flame is sometimes seen burning on the top of a chimney stack. This is caused by an insufficient supply of secondary air being added. The carbon monoxide, not being wholly burnt, is carried forward ; and on coming into contact with the atmosphere, burns there instead of in the retort setting.

Gas Analysis.—I have not thought it here necessary to enumerate the various processes of gas analysis applicable to the testing of furnace gases, with which no doubt most of you are more familiar than myself.

Composition of Various Gases.—The producer gas should theoretically contain 34.7 per cent. carbon monoxide and 65.3 per cent. of nitrogen ; and the waste gases would then contain 21 per cent. of carbon dioxide. These, of course, are theoretical figures, and are never obtained in working. It may be considered good working if the producer gas contains 6 per cent. carbonic acid and 30 per cent. carbonic oxide, and the waste gases 12 per cent. carbonic acid and about 3 per cent. oxygen. Hydrogen is always found in the various gases. This is caused by the water from the ash pans being evaporated and being decomposed. An analysis of waste gases from a Klönne regenerative setting gave the following results : Carbonic acid 12 per cent., carbonic oxide 7.6 per cent., oxygen *nil*, hydrogen 6.6 per cent., and nitrogen 73.8 per cent.

Aim of Working.—The aim in working a gaseous fired setting should be to produce as much carbon monoxide as possible in the producer, and to burn the whole of it to carbon dioxide in the combustion chamber. The nearer this state of perfection is reached, the greater will be the heat of the setting.

Heat at Points of Setting.—The heats of the different portions of the setting, as given by Grsham, are about as follows :

Producer gas, 2,000° F.
Secondary air, 1,800°.
Products of combustion, 2,500°.
Waste gases enter regenerating flues at 1,900°.
" " leave " " 500°.

Clinkering.—It is a mistake to be constantly clinkering a fire. It should be done at regular intervals, and done thoroughly. Clinkering necessitates a certain loss of coke during the operation ; and the clinker is not so efficiently removed if it is not allowed to form properly. How often a furnace is to be clinkered will depend largely on the class of the fuel used. It will usually run 24 to 48 hours after clinkering.

Clinkering of the Klönne furnace is performed as follows : A number of pieces of flat iron called needles, about 5 feet long, 3 inches wide and ¾ inch thick, having a hole in one end to withdraw them by, are forced through the mass of fuel just below the water pan on the top of the dead plates ; the ends or points resting on a wall at the back of the setting. These false bars hold the fuel up while the ordinary fire bars are removed and the clinker is thoroughly cleaned out. It is important that this should be carefully done, as the clinker will form more rapidly if there is any left sticking to the sides. When the clinkering is finished, the fire bars are replaced and the false bars are withdrawn ; and the fuel falls into its proper place.

Water.—The water supply first runs into the cast iron dish, then overflows over the dead plates, and finally finds its way to the ashpan, from which it evaporates and keeps the fire bars cool. It also keeps the front of the setting cool ; but the most important function of the water which is evaporated from the ashpan is the prevention of the formation of clinker by reducing its temperature. This makes it more of the nature of an ash, when it is much more easily removed. Steam is frequently introduced into the furnace under the fire bars for the same purpose.

The water of evaporation with the introduction of steam produces the hydrogen which is found in the producer gas. Thus the aqueous vapor (H_2O) is split up into oxygen and hydrogen. Although at first sight this might appear a beneficial reaction, the heat absorbed by the decomposition hardly makes it of any thermic value.

Discussion.

Mr. Braddock pointed out that the author had not said anything about the quantity of coke used with the regenerator furnace per 100 pounds of coal carbonized. In their case they found that in furnaces with inclined retorts it was about 1.3 pounds, as against something like 27 pounds with direct firing. Of course, it was difficult to get at the exact quantity ; but these figures gave them a rough idea of the amount used. He would also like to know something as to the state of the bed during stoppages of (say) 12 to 24 hours, as on Sundays. At their own works, they found some little difficulty on such occasions.

Mr. Hill remarked that the coke in a furnace did not always settle down as it should do, and if it were not pushed down it left a channel on each side, which, he conceived, might cause inconvenience in connection with the ascent of the gases. He had an idea that the furnace might be made in a form similar to that of a cupola, so that the coke would drop properly without leaving the crevices or channels to which he had referred.

Mr. Mottram said the author had told them that at most gas works they were building either generator or regenerator furnaces. He would like to ask if Mr. Chandley did not know of any other method whereby the work could be done equally well, and also what quantity of gas per ton of coal he could sell with the regenerator system. Mr. Newbigging, at Macclesfield, sold 10,500 cubic feet to the ton, with a direct fired furnace of his own improved setting. It was claimed that this was a very good paying arrangement. Of course, the question of making the thing pay had to be looked to. In the case of the regenerator, they had to consider the cost of removing naphthaline, which obstructed the pipes over the town. This was due to high heats. At Hyde, on the other hand, with direct firing, they never had a case of such stoppage. The expense involved in clearing the pipes was consequently an item not to be overlooked, in the case of regenerating furnaces ; and he believed that in some towns it was pretty considerable. There was also the cost of clearing the stopped ascension pipes. He knew of one place where they kept two men at the top of the stack, day and night, doing nothing but clear out the pipes. This was not necessary once in two or three weeks at Hyde, which meant a saving in wages. Then, again, they obtained a better price for their tar, when they had the direct fire.

A member asked what was the amount of vacuum required at the damper to work the setting in the furnace described by the author.

Mr. Hill said, in his opinion, the deeper they made a furnace the better results they would obtain. There was what he might term a longer mass of hot coke, and a better chance of carbonic oxide being formed.

Mr. Stoddart said he understood the author to say that the hydrogen had no effect in giving off heat ; but he (Mr. Stoddart) could not help

thinking that it must give off a certain quantity. The theory of regenerators was very good, but the question was whether it would pay to go into the increased make of gas per ton of coal carbonized. There was the naphthaline trouble, and the deteriorated value of the tar.

Mr. Braddock remarked that there was not trouble with naphthaline in all cases where they had regenerator furnaces. In many places there was not the slightest difficulty in this respect.

Mr. Critchley said that from 24 to 48 hours seemed to be a long interval to allow between the times of clinkering.

The Chairman asked the author whether there was very much to be gained by adopting regenerator in place of generator furnaces, and whether they got a proper equivalent for the increased cost of the former type. With regard to the quality of gas, he had often heard customers complain when the illuminating power was exceptionally high, and say the light was better when the power was actually lower.

Mr. Chandley, in replying on the discussion, said he had not gone into the question of the amount of fuel used for working regenerator furnaces; but taking the balance sheets of the two systems—viz., ordinary fire settings and regenerator furnaces—he had found a gain of exactly 51 per cent. in the amount of fuel used. He did not mean to say this was always the case; their direct fired furnaces might possibly have been particularly bad specimens. The amount of fuel used in the setting, however, would probably be about 30 cwt. for every 6 tons of coal carbonized. With regard to the hydrogen, what he had meant to say was that, taking into account the heat absorbed by the conversion of the water of the steam into hydrogen, it was not compensated for by the value of the hydrogen when burning. As to stopping the retorts at the week ends, they never did this, but had the bed stopped for two or three days; and the only danger was that it got exceedingly hot. By closing off the primary air supply, they could reduce the setting to whatever temperature they wanted. As to the advantages of regenerator furnaces, he could not go into figures as to the quantity of gas sold per ton of coal. Using 4 per cent. cannel, they would get a good amount; but with slack they would not. They had to consider the kind of fuel used, which greatly affected the result. The saving of 50 per cent. in fuel which he had mentioned was, however, sufficient reason for putting in regenerator in place of direct fired furnaces. Of course, the points of cheaper working, higher heats and greater make per ton of coal carbonized, did come in; but the saving in fuel was quite sufficient justification for adopting regenerator settings. Of course, there would be a difficulty as to stopped pipes, even with ordinary furnaces, when they were allowed to get too hot. With respect to naphthaline, it was produced by high heats, to a certain extent; but there was a lack of definite information on this point. As to tar, they would not get as much benzol in it with high heats; but unless they obtained proportionately higher prices for the tar according to quality, the point was not of very much importance, as if they did not get the value in the tar they got it in the gas, so that it was not lost. He did not think there was much difference in the prices obtained for tar. He fancied that tar distillers did not go closely into the chemical analysis of the tar before giving a price. The vacuum on the setting shown in the sketch was about 1 inch on the chimney shaft, though it depended on the state of the flues. With regard to clinkering, he had known men to "tickle" every two hours, but not to clinker anything like so often. They clinkered every 24 hours; and in some works every 48 hours. As to the quality of the gas, he thought that the average outsider's opinion on gas matters was not one to be taken seriously.

A Court Decision as to Responsibility for Damage by Electrolysis to Gas Mains.

Engineering News says that an interesting and possibly an epoch-marking decision relating to the responsibility for damage by electrolysis to underground pipes has just been rendered at Indianapolis, Ind. The decision is a preliminary one, in the Superior Court, overruling a demurrer in which the defendant sought to set aside the case, but inasmuch as the case is to be heard by the same Judge on its trial, and because the text of his decision covers some of the points at issue in the case itself, it is likely that the present decision lays down principles which will be followed later on.

The action in question was brought by the Manufacturers' Natural Gas Company, against the Indianapolis Street Railway Company, for damages done by its currents to the pipes of the Gas Company. Mr. F. A. W. Davis is Manager of the Gas Company, and we are indebted to him for the following abstract of the decision:

The method in use by the defendant in operating its cars results in serious injury and in some cases to the destruction of plaintiff's pipes. The defendant can, by the use of an approved appliance at reasonable expense, so operate its cars as to avoid injuring the plaintiff's pipes. The plaintiff cannot, by any known method, protect its pipes from injury.

The plaintiff owns its pipe line laid in the street by legal authority. Such pipe line is property within the meaning of the constitution and laws. It is subject to taxation; it may be sold and purchased as other property. The Street Railroad Company seizes on these pipes and makes use of them as a conductor for its return current, and in so doing greatly injures and in some instances wholly destroys them, and this is done under a claim that it is performing a public service under authority of law. Is not this a taking of private property for public use and for which just compensation must be made?

I do not see that the fact that the Street Railway Company's tracks, poles and wires may have been placed in the street before the plaintiff's pipes were so placed can make any difference, unless it should be shown that when the plaintiff placed them there it knew of the injuries to which they would be subjected.

The city could not and did not grant a monopoly of the street either to the defendant or its predecessor, and when the tracks, poles and wires were placed in the street the Railway Company knew that gas and water pipes might be laid in the street at any time, and it acquired its rights to run an electric road subject to that fact, and all the consequences that might follow. The plaintiff is not a trespasser, but occupies the street lawfully, and while there its property is taken by the Street Railway Company as a consequence of its operations.

Justice Brown, in the case in 42 Fed. Rep. 279, states that the substances of all the cases which he has examined is that:

Where a person is making lawful use of his own property, or of a public franchise, in such a manner as to occasion injury to another, the question of his liability will depend on the fact whether he has made use of the means which, in the progress of science and improvement, have been shown to be the best.

A street railway company is not, however, bound to adopt the latest invention, nor to adopt any, before its utility and practicability have been demonstrated by use.

The case made by the complaint in this cause seems to meet the requirement contained in Judge Brown's statement:

According to the allegations of the complaint, the defendant has failed to adopt an approved appliance which could be done at a reasonable expense, and when by so doing the injuries complained of could be avoided.

I cannot see any difference in principle between a case in which liability attaches from a failure to adopt the best known device and one where there is a failure to adopt any device whatever, when there are devices by which the injury could be avoided, and the utility of which has passed the point of being a mere experiment.

These questions are new, and we are without precedent in decided cases for our guidance, but as these new questions arise the administration of the law should keep step to the new situations arising in the march of scientific invention and improvement, not by inventing new legal principles, but by the expansion of old and well recognized principles of law and equity so as to meet and cover the new situation. It would be a reproach to our system of jurisprudence and the administration thereof if a situation could arise in which large and material injury should be done to legal rights and destruction caused to property and the law be powerless to apply a remedy.

Take the situation in this city. The number and size of the cars propelled through our streets by electricity is ever rapidly on the increase. Suburban lines are coming into the city from every direction with cars larger than ever before used on the streets, and the currents of electricity which now are, or soon will be, discharged into the earth of the streets are very large, and if it be true, as claimed in some of the cases which I have examined, that these currents not only attack gas and water pipes, but the steel frames of tall buildings as well, and that such steel frames may be deteriorated and weakened so as to imperil such buildings, is there no remedy in the law to prevent it, or to compel the Street Railway Company to control its return current when it is conceded that it is reasonably in its power to do so?

Where a corporation is exercising a public franchise, and does so in such a manner as to cause actual material injury to legal rights and destruction of property, when at reasonable expense, by the adoption of well known and approved appliances, the injury could be avoided, and the person injured is powerless to prevent or guard against such injury, then I think it must be held to be negligence in the use of its franchise on the part of such corporation not to adopt such approved appliances.

The destruction of the plaintiff's pipes so as to permit gas to escape and cause destruction to life and property cannot be said to be mere annoyances, inconveniences or incidental damages. It has been held in New York, in the case of Siebrecht *vs.* East River Gas Company (47 N. Y., Supp. 262, 1899), that the Gas Company is liable in damages sustained by the action of gas which escaped from the Company's pipes from leaks caused by electrolysis; to be subjected to such a liability cannot be considered a mere incidental damage.

For the foregoing reasons I think the complaint states a good cause of action, and the demurrer is therefore overruled.

Uniform Municipal Accounting.

According to *Engineering Record* a special committee of the American Economic Association submitted at the meeting of the Society the last week in December a report on uniform municipal accounts and statistics which calls for criticism. Uniformity in municipal statistics is desirable for many reasons. City officials recognize this and, if the ordinances and regulations for municipal bookkeeping permitted, the reform would be comparatively easy to bring about. It is wrong to a great number of faithful, competent city clerks and treasurers to accuse them indirectly of incompetence, laziness or ignorance because their reports do not enable the reformer to obtain statistics for his lucubrations without trouble to himself. The report mentioned above is an evidence to anyone who has really taken part in the municipal government of a large community, that the committee which prepared it has little appreciation of the human element of city accounting, for its conclusions are stated in a manner little short of insulting to the officers most able and willing to bring about the reform. These conclusions are:

"1. That the interests of good municipal government, economics and public finance demand the collection and publication of State and national municipal statistics." This is true, if the *Engineering Record* understands correctly the astonishing English in the last part of the sentence.

"2. That such statistics, to be of service, should be based on uniform municipal accounting." This is not necessarily true, although it would save money to compile them in this way.

"3. That, as a rule, American municipal accounting is in a most deplorable condition, being unsystematic, incomplete and misleading; with little correlation between the accounts of different departments of the same city, and the utmost diversity in the accounts of different cities, rendering comparison of the working of different departments and cities always difficult and often impossible." Such a sweeping, deliberate insult to hundreds of city officials deserves the strongest condemnation. Systems of public bookkeeping have not been instituted for the good of humanity at large, but for the accounts of the communities which pay for the work. Because those systems do not agree in every city and render a comparison of the cost of the same work in different communities a difficult matter is no proof whatever that any one of the systems is incomplete or misleading.

"4. That certain mooted questions of public policy, like municipal ownership, and day labor as compared with the contract system of executing public work, can never be thoroughly or properly studied until greater uniformity in municipal accounts and reports has been secured." It is difficult to understand the intellectual processes which lead anyone to believe that such questions as those mentioned can ever be settled by statistics; human nature, which settles such matters, is somewhat difficult to express in figures.

"5. That co-operation between the various economic, sanitary, engineering and other technical societies interested in or devoted to municipal affairs, or some branch thereof, should be encouraged, to the end that uniform schemes for municipal accounts and reports, covering the various municipal undertakings and interests, whether in public or private hands, may be formulated and adopted." This is an excellent suggestion and deserves the strongest support.

There are three more clauses in these conclusions of the committee, but they relate to general matters and need not be here mentioned. The report, it is only fair to add, is put forth merely as a progress report. Very likely the committee will do much better when it has learned more of the subject by consultation with the officers who do the accounting for our cities. The document recently submitted is so lacking in evidences of a practical knowledge of municipal accounting, that it will carry weight only with the very few men, mostly students of sociology, who yearn for statistics they do not possess and have no conception of the extreme difficulty of changing the bookkeeping of American cities to gratify their desires. Improvements are bound to come in municipal accounting; they will not be introduced, however, to gratify a few amateur statisticians, but because they are needed for the better conduct of public affairs.

Electric Lights Along the Coast.

By Mr. Geo. E. Walsh, in *Electrical World.*

In the construction of lighthouses, lightships and signal lights of a miscellaneous character along our coast to warn mariners of their danger, electricity has only recently figured to any great extent. There are some 9,000 "aids to navigation" scattered along our ocean and lake coasts, and these vary in size and importance from the small beacon to the most powerful lighthouse in the world. These lights, beacons and buoys are operated by steam, hot air, gas, electricity and by the force of the waves. More than 6,000 of these "aids to navigation" are of use only in the daytime, and the other 3,000 send their warnings across the water by means of powerful lights.

For hundreds of years the lighthouses of the world depended upon the oil lamp for their signal lights, and inventors multiplied their intensity by inventing new forms of reflectors. It is a notorious fact that on some of the foreign coasts these old fashioned oil lamps are still in existence, and even on our own coasts the modern gas or electric lights are of very recent introduction. The United States Lighthouse Board has gradually been reorganizing the whole lighthouse service, and to-day nearly all of these sleepless watchers of the night are provided with electricity. The cost of this lighting agent has been the chief obstacle in the way, and even to-day there are isolated coasts and points where the Lighthouse Board has not felt justified in introducing the electric light.

Where it has been impossible to use the lighting power from some neighboring electric light plant, the government has in a number of instances established its own plant. Acetylene gas has been employed in many a lighthouse located where it was not considered wise to establish an electric plant. This gas gives a much better effect than common illuminating gas, and it is used much in buoys where gas is the lighting agent.

The revolution in the work of lighting our coast is coming slowly through the application of electricity to various kinds of buoys and beacons. Some time ago the Lighthouse Board made successful experiments with electric buoys in New York Harbor. By means of an electric cable connecting the line of buoys marking the channel, the passage up the harbor could be made as easily as in the daytime. There is little question but harbors will be ultimately lighted in this way by electric buoys, especially for a part of the night. The delay of incoming steamers and ships in a port like New York because of the danger of navigating a narrow, crooked channel is a matter of considerable commercial loss, and anything that would facilitate the landing and docking as soon as the steamers arrived would prove of great advantage to the shipping interests.

In establishing such lines of electric buoys the question of cost must always be considered, and at present the Lighthouse Board has not proceeded beyond the experimental stage. In other lines of work with electrictty, however, something more than experiment has been attained. Nearly all the future lightships will have an electric light plant on board to furnish sufficient illumination to warn ships off the shoals. This departure from the old fashioned lightships will be noteworthy in many respects. The ships will be provided with hollow iron masts, and at the top of each will be grouped half a dozen incandescent lamps, each of 100-candle power. There will be two complete sets of electrical apparatus, so that if one should be deranged the lights would not suffer.

The first and most powerful of these modern electric lightships will be located off Cape Hatteras. The famous Diamond Shoals is the scene of this new venture. For half a century these shoals have been the most dangerous point on our coast. The shoals are formed by the powerful set of the tide up and down the coast at Cape Hatteras, which juts further out into the Atlantic than any other point of land south of the Delaware Capes. Storms seem to be forever brooding off this point, and the shifting nature of the sands makes it impossible to warn passing ships without a light. Numerous wrecks have occurred on the shoals, and vain efforts have been made to build some sort of beacon or lighthouse at the place. The latest attempt was to sink a huge caisson into the sandy bed of the shoals and then build a lighthouse up from this secure foundation. Twice the company employed in sinking the caisson was baffled and the caisson was finally wrecked. Several lightships have been anchored there at various times, but they were torn loose from their moorings and carried out to sea.

The construction of a special lightship was then ordered by the lighthouse board, and this is the most modern and improved type of lightship in the world. The lightship is steam propelled and electric lighted, and is 112 feet long, with a beam of over 28 feet. The ship is built of steel, with watertight compartments. The dynamos and engines for the electric light plant are located on the main deck and in the engine room and boiler casing. The wires run from the plant through the steel masts to the flashlights. There are three of these flashlights on each of the two hollow masts, and they are arranged for oil as well as electricity.

The lights are nearly 60 feet from the water line. These six mast head lights are of 100-candle power 100 volt lamps, and they can be seen many miles at sea at night time. They are regulated on the automatic flash system, which is controlled by a belt from the dynamo shaft. There will also be 80 16 candle power 100-volt lamps placed at different points on the ship. These are intended to illuminate the waters so that a passing ship could not mistake the meaning of the lights. The electric plant is driven by two double cylinder engines.

The lightship itself will be operated and controlled by steam. There will be a steam siren and a steam whistle to warn vessels off. The mooring apparatus will be of the most elaborate type, and the tackle will all be operated by steam or electricity.

The power of the illuminating lights for both lighthouses and lightships has not only been increased in the last few years by the adoption of electricity, but also by the improvement in the reflectors and lenses. These lenses are ground so fine now that the lighting effect is doubled and trebled in some instances, and the navigator to-day can distinguish the lights of the coast two or three times as far out at sea as formerly.

The Lighthouse Board has been experimenting extensively with electric flash lights for the purpose of adopting a uniform system of signals along all the coasts. The great trouble with arranging lights has been to find suitable variations of lights to give sailors an accurate knowledge of their whereabouts. The use of the colored lights, either as stationary or flash lights, has the disadvantage of failing at a critical moment through the color blindness of the navigator. More than once signal lights have been misread through this trouble. It is impossible to make tests of all navigators as to their color blindness, as is the rule on the railroads, and the dependence upon colored lights is deprecated more and more each year.

The modern lighthouse not only warns mariners of danger, but it is supposed to inform them of their exact location. This is done through a system of electric light flashes, according to which each lighthouse emits a certain number of rays of light, followed by total eclipse, and then by other flashes. These rays of light are supplied by electricity and are as powerful as the electric arc permits. Mariners' charts give the key to each light. By referring to this chart the navigator can tell instantly what light he is sailing abreast. By means of the electrical apparatus the simple opening and closing of the circuit will furnish automatically the desired number of flashes per minute. There is no other power or agent that can furnish similar powerful flashes in the order needed, and electricity will come to be installed in all lighthouses where the flash system is in use, displacing the present clocklike machinery to produce the flashing effects, as there are many insurmountable difficulties in the way of its efficient working. The electric light system has so far proved by all odds the most economical and trustworthy, and its adoption as the only really satisfactory one for lighthouse service seems assured. More money is spent by the United States than any other country in the improvement of its lighthouse service, and it requires between $3,000,000 and $4,000,000 a year to support it. Efforts are being made to reduce this cost by constructing machinery which can be operated by the waves. In this way it is hoped to generate sufficient electricity at little expense to furnish the lights.

[Concluded from Page 5.]

The Future of the Gas Profession.[1]—No. III.

Another question that crops up at intervals is one which, in the interests of the gas industry, should be well threshed out, and that is the position as regards outside or opposing interests. Is it right or desirable that a director or committeeman should be a substantial shareholder or hold a responsible appointment in connection with firms whose tenders come before him for consideration? Or for the principal salaried officials to be interested in a similar manner, or by way of royalties on patents? But few directors or officials could claim to be absolutely free from some connection of this sort; and if we look further afield, we find that it is the general business practice to make one thing help another. If a clean sweep was to be made of our gas works, board rooms and offices in respect to everyone who could not say that he held no shares in a trading company doing business with gas works undertakings, or had no interest in any patent exploited by such companies, the residue that remained would not be sufficient, either in quality or quantity, to effectively carry on operations. And with the continual increase of joint stock enterprise, the conversion of individual businesses into companies, and the amalgamation of large firms, the inducements to remain immaculate do not increase. Scarcely a week elapses without every director or principal officer receiving prospectuses, allotment forms, etc., offering him the opportunity of securing debentures or shares in some joint stock concern for the supply of ironwork, stoves, meters, fittings, burners, and so on. In this connection, I have often been surprised that the coal trade—who, according to their account, get their living by losing heavily for 9 years out of 10—do not exhibit a disposition to share their losses by a similar process. But the prospectus of a colliery company is as rare as a dead donkey. Another peculiarity is that this kind of document is frequently delivered by the postman on the Sabbath day; and I am told this is not always a matter of accident, but that the senders believe themselves, by this means, more likely to receive careful consideration, which would seem to show that Sabbath breaking is not confined to Sunday leaguers or cyclists, and points to the need of an association which would agree to destroy unread on Monday morning any prospectus or circular that came to hand on the previous day.

I should be sorry to say a word against those who advocate strict honor and probity in business methods, and have great sympathy with their intentions. But most reformers manage to get the character for being unpractical; and in this case they are apt to forget that it is impossible to make men honest by Act of Parliament, and that if every interested director or officer was displaced to morrow, there is no guarantee that their suecessors would show an improvement in the matter of clean handedness or honesty. The handing over of the management of a gas company to a committe of bakers and shoemakers, would not of itself be a guarantee for strict plain dealing in the future. It would be more a question of personal character than of business connection. It is just the man who makes an efficient gas director that is likely to be in demand in regard to other undertakings; and the engineer who exhibits tact in the construction of one gas works, is sure to be consulted about others. More than this, the director will increase his experience by his connection with other similar undertakings, and in many ways become the more valuable.

An engineer, too, who goes to advise another concern, will return with freshened and broadened views which will greatly assist him in the matter of future extensions at home; and he will have gathered useful ideas for the improvement of his own present practice. The industry would lose more than it would gain by the introduction of any stringent measures in this connection. There are instances of dishonest practices and of feathering one's own nest to be quoted, and possibly of influencing contracts in a reprehensible manner; and there always will be, while human nature remains what it is. But for every case of this sort, there are two or three on the other side. For example, a member of a firm of gas engineers and contractors has a steady, well established business, and but little temptation—to say nothing of inclination—to enter upon underhand practices. He is requested, as a favor, to accept a seat on the board of a gas company, and in this capacity repeatedly acts as consulting engineer, and saves the cost of fees. His co-directors look upon his wide professional experience as of great value in regard to all matters that come before them. When a question of extensions arises, the board think themselves quite justified in putting a little in the way of their colleague. They say, with some reason, that he, being always on the spot to answer for the quality of the work, will do as well for them as anyone else would. All this is very unparliamentary, and certainly *might* lead to awful abuses. But it is ordinary business practice, and in nine cases out of ten is really the best course in the interest of the concern. The engineer director accepts the work in the spirit in which it is offered, and carries it out in a fair, straightforward way; seeing that his firm do not lose, but also avoiding unnecessary expense to the company, and saving them money by substituting second hand apparatus for new where this can be done with advantage, as in the case of rough castings. Or the engineer of a large undertaking may be asked to accept the appointment of consulting engineer to a small one in the neighborhood. The engineer-director *might*, of course, plunder the company, and the engineer-manager *might* consider the interests of his outside practice to the

1. *Journal of Gas Lighting.*

detriment of his permanent one ; but the cases where this occur are the exception, and not the rule.

The days of slavery and serfdom are past ; and every individual is entitled to a reasonable amount of leisure and to freedom in the use of it. He is also entitled to absolute freedom as regards investment of his property. Any attempt to encroach upon these rights without offering a fair equivalent, is of the nature of tyranny, and will not tend to the development of the industry at large, or to the real prosperity of the particular concern. It may be smart practice, when there are a hundred candidates or so for a vacancy, not only to cut down the salary, but to put in stringent clauses about not engaging in other work, not leaving the district without permission, or not having shares in trading companies. But will the "lucky" man who secures the appointment feel inclined to respect his employers, to take a great interest in the concern, or to put more power into his work than is absolutely dragged out of him. Nor are such limitations likely to recommend the gas industry to the attention of the superior orders in intellect and ability.

Any examination with a view of giving a certificate of fitness for the management of a gas undertaking is but a one sided affair, if it does not take into consideration the physical condition of the candidate. The man of science may go into his laboratory and deal as he likes with his bottles and glasses, retorts and crucibles ; but the manager of a gas undertaking must be prepared to consider the peculiarities of his directors, his employees and his customers. In the present rush for education, there is a tendency to forget that, although a young man may emerge triumphantly, so far as book knowledge is concerned, from a course of (say) 10 years' study at 15 hours a day, he may also be a physical wreck—muscles soft and flabby, nervous system hyper-sensitive, with appetite and digestion poor. How can we expect a pallid, slope-shouldered, knock-kneed sort of a man to deal with a strike among the stokers, the collapse of a holder, the failure of a principal main, or with less important matters that turn up every day? No amount of success at an examination will give him muscle, nerve or digestive powers ; and he wants a good allowance of all three in order to successfully control the numerous departments of a gas undertaking. One reason why any intelligent workman, in spite of educational disadvantages, may, and does, rise to the control of a gas works, is his sound physical health. He can stand about for hours at a time, watching the progress of operations ; and, if need be, take a hand with the tools himself. His old experiences as a workman stand him in good stead, on the same principle as that a retired criminal makes the best detective. But the great point is that his physical condition is not disturbed by worries and casualties that would send his intellectual superior home to bed, temporarily incapacitated by nervous headache or such like ailment.

So far I have touched upon the weak places in the gas industry, and some of the causes which have hindered its advancement. We boast sometimes of the increase in the consumption of gas ; but really—looking at the degree of refinement arrived at by the manufacturers of gas fires and cookers, at the great economy of gas for lighting that is rendered possible by the introduction of the incandescent burner, and the innumerable applications for technical purposes—we should be examining into the reasons why it is not greater. Gas is by far the cheapest agent for lighting and cooking ; and also for warming when its convenience and saving of labor are considered. But its use is not so general as these advantages would lead one to expect. In every town there are not only single houses, but whole rows, into which the service pipe has not yet penetrated. It is a standing disgrace to the industry that the first organization of a body of canvassers should have been left to a manufacturer. Who ever heard of a gas company in England undertaking a house-to-house canvass—a proceeding which American gas managers, who do not neglect this department as usual in England, have pronounced to be indispensable? Under a more energetic and enlightened directorate and adequate staff, the sales of gas might be at least 50 per cent. more than they really are.

We are drawing close up to the end of a century—a season which renders us inclined to review the past, and make resolutions for the future. We look back with regret over the lost opportunities of the years gone by, and forward with hope as to the possibilities afforded by those that are coming. And in this connection, I can readily imagine a time when the duties of the directorate should be defined and limited to such matters as the capabilities of an influential experienced man of business, having a good general (but no special technical) knowledge, can efficiently deal with ; and when the whole of the operations, commercial, technical and general, shall be under the control of an experienced manager, with the aid of efficient clerical and technical assistance in the various departments. There should be general responsible supervision over the whole, in preference to dividing up the operations between two or three heads. In regard to establishments of the first magnitude especially, there has always seemed to me to be too great a *hiatus* between the manager at about £2,000 a year and his assistant at £200 ; and between the secretary at £1,000 and the chief clerk at £150. There is room for a good class of second-grade officials, receiving perhaps one-half of the salaries considered sufficient for the chief, and possessing in their own departments a certain amount of responsibility, but subject to head control. According to theory, there is wisdom in the multitude of councillors ; but in practice the real work is done by the few. Out of a board of six or seven, one or two really guide the decisions ; and the rest simply say "Ditto to Mr. Blank." Nor is there any particular objection to this, provided the right kind of men get the upper hand. For successful working, there is nothing like a vigorous personality. There is also need for a larger staff—one able, not merely to keep the thing moving, but to develop all possible resources, either commercial or technical, and to keep well up with everything that is being done elsewhere. There is room for more investigation in respect to materials purchased and the results obtained from them, to say nothing of pure research. The same as regards the sales department, in respect to new appliances that are continually being put forward.

So much for the particular. As regards the general state of the gas industry, I could imagine our "Institute" supported by all branches of the gas industry, but in which the income from gas undertakings would be at least five times that of the members' subscriptions ; having not only an adequate income, but a strong position, and able to deal, not only with technical, but also with commercial matters ; and having good educational facilities, in addition to an Examining Board whose certificates would be generally recognized, and of graded orders of merit, so as to avoid the glaring inconsistency of stamping a young man of 21 years of age as a full blown experienced gas manager. There would be a good reference library, with accommodation for reading abstractors ; and it would be a usual thing to send a junior from the provincial gas works to get particular information. There would also be committee rooms, where the various orders of certificate holders could meet and discuss matters peculiar to their own particular branch, and the members would be encouraged to attend by their employers, and have their expenses paid. A suite of laboratories, testing rooms and workshops, and even an experimental gas works at some place within easy reach would be available ; and, if required, tests, examinations and reports would be undertaken at fixed fees. Are these practical suggestions, or Utopian dreams?

Industrial Policy and Foreign Competition.

Engineering in its last issue for 1900 contained the following editorial :

A good many engineers will look back on the closing year, and forward to the year about to commence, with mixed feelings. To most, the past 12 months have been the continuation of an era of pleasing activity which, perhaps, is drawing to a close. That it should do so is in accordance with experience ; and many British manufacturers will doubtless console themselves with the thought that the ebb of trade will, in due course, be succeeded by a recurring flood tide of prosperity. With some, however, there may be an uneasy feeling that we are entering on an era of change, which will make the reaction from depression less automatic than it has formerly been. The latter class may be in the minority, for it takes a good deal to shake the confidence of the Briton in himself or his country. That natural characteristic has stood us in good stead in times past, but, like most virtues carried to excess, it easily degenerates into a vice ; a source of weakness rather than of strength. "The Lord gie us a guid conceit o' oursels," the Scottish lady prayed ; unnecessarily, one would think, for a true Caledonian. However this may be, a pinch of conceit is good for character, as salt to porridge, iron to the blood, or lime to our bones ; it gives flavor, color, stiffness ; without it there is a moral flabbiness which unfits a man for the push of life's struggle. "The English never know when they are beaten," said the greatest opponent England ever had. That quality is creditable to Englishmen so long as they know they are not beaten, because they are doing their utmost to win. There is a great difference between self confidence and self complacency.

The application of these few commonplaces to our present purpose is that foreign competition is not what it was, and that conditions are not going to be for us, in the twentieth century, quite so easy as they

were in the nineteenth. Even the most buoyant spirited Briton, with the profits of 5 fat years swelling the balance at his bank, is not without a suspicion of this—a haunting fear there may be rats in his granary and a wolf near the fold. The feeling has been in the air for some time past; but prosperity has dulled our senses, and only faint echoes have reached our ears. "Made in Germany" was the first; but that, we said, was only because the Germans made things so cheap—"and so nasty," as we never forgot to add—until the biggest and fastest ship in the world steamed up Southampton Water with "Made in Germany" written on her side. Now the ship building industry, as all the world knows—for we have told it often enough—is the one particular thing in which Britons never will be approached. We also said the same thing of the iron industry; but not for the last few years, because the United States have taken, not only to making a great deal more iron and steel in the year than we do, and not only to sending it to foreign markets we once thought unassailably our own, but even to attacking us in our stronghold at home, so that British ships are being built with American steel.

"A mere *tour de force*," says an indignant British steel maker. "An abnormal circumstance, due to the peculiar conditions of the country from whence the steel comes, and the exceptional state of the market." Well, it may be so; but to some who know the peculiar conditions of the country quite well, it sounds a little like the distant baying of the wolf.

Then there is a nibbling and squeaking from Belgium, where they make rolled joists; and a loud threatening howl from Germany, where they make very big steel castings (and also very little ones, with no unexpected hard places to break drills; and where, in fact, they make more steel in the year than we do, although we have the satisfaction of knowing that it is mostly by that basic process we ourselves invented and then despised); and a sharp bark comes across the water with a cargo of rails for Aberdeen. Indeed, if we can rouse ourselves from our easy chair in front of the fire and throw open the window wide, such a sound of hungry barking, yapping, roaring, growling, grunting, and squeaking comes through the keen air of the century's dawn that, if we are wise, we shall change slippers for boots, reach down the gun and slip round to the fold before the whole pack is over the fence.

England still holds the best cards in this great international game of industrial rivalry; but they must be played for all they are worth to win. We are the front door of Europe; our geographical position on the great highway between two hemispheres is unrivaled; we have experience, reputation, and connection—what is known in trade as "goodwill." The solidity of the national character makes London the greatest banking center in the world; we have accumulated capital beyond any other country; our means of internal communication are well developed, our ports sheltered, our harbors secure, our shipping industry is almost without a rival, and our broking and commission business is also the largest in the world. The mineral resources of the kingdom are not pre-eminent to the extent they once were, so we may have to look abroad for a greater bulk of raw material to keep mills and factories supplied; but the vast amount of capital invested abroad—interest for which is returned in the shape of commodities—and the supremacy we hold in the ocean carrying trade go far to neutralize any advantage other countries may hold in raw material or in the production of partly manufactured goods. It may be that the richer natural resources of some of our rivals, and the intelligence with which they have been used, will wrest from us certain markets we once thought secure, but even here the enterprise of competitors may be used with advantage under our open fiscal policy. When all is told, nature and our forefathers have given us an inheritance which needs only to be used to command a full share of the trade that is now to come through the spread of civilization, of which the United States and our own colonies show the beginning. Vast tracts of territory in every quarter of the globe will have to be supplied with railways before the coming century closes; thousands of miles of coast line will want harbors, piers, docks, and warehouses; millions of people, now often hungry and naked, will demand food and clothing that will need for their production machinery of all kinds. Mineral riches in Africa, China, Siberia, and Canada, products of India, Australasia, and South America, are waiting to be developed by populations that have hitherto mostly supplied their own needs by their own exertions, and with primitive appliances. For many years millions of uncivilized, or hardly civilized, people will have to be fed, clothed, housed, and amused by the products of mills and factories situated in distant centers of commerce. The prospect of trade is enormous, exceeding anything that has gone before. What is to be our share?

The answer depends on ourselves; and it must be given at once. Not by Parliaments, or County Councils, but by the manufacturers, merchants, and, perhaps still more, by the working men of the country. The matter is urgent; there are too many mills and factories in America, Germany, and elsewhere, to make it safe to dally, while we are spending some of that money we have worked so hard to earn. The stream of commerce flows in the deepest channels; if others dig deeper, our water courses will run dry. It is difficult to direct the flow, but when once altered it is far more difficult to win back. Manufacturing industry is like a big mill engine with a heavy fly wheel; shut off steam, and it will run a long time by its own momentum. But if the stoker goes to sleep and lets the fires out, and the boilers get cold, it takes a long time to get up steam again; especially if the master has neglected to supply coal.

This country has great material resources, as we have shown, but the great question is: Has she the men? For it is men, more than materials, that make a nation. It is a question most of us answer in one way without hesitation; but perhaps it would be well to ask ourselves by what consideration the ready answer is prompted. Is it because our fathers, building on the foundation of invention laid by a group of men of genius, have in the past reared an edifice of commerce, the like of which the world has never seen before? Is it because they, again in the past, finding a virgin field, cultivated it to its full bearing capacity, unchecked by rivalry and unhampered by opposition? Is our belief in our present selves due to careful observation of the people of other nations, and an impartial comparison of them with our own? Or is it built up from flamboyant newspaper articles, patriotic speeches to constituencies to be won, or crowds to be tickled? Is it from a desire to speak well of our more immediate neighbor—in fact, not to foul our own nest? Are we seeking to put aside an unpleasant problem, to find an excuse for greater leisure, for more self indulgence? When we engineers say the British working man has no equal in the world, are we thinking of the actual mechanic, with his trade union principles of one man one machine, and a standard of work reduced to the lowest capacity in the shop; or have we in mind an imaginary being, the outcome of the late Mr. Brassey's beef fed navvy, who could wheel more muck on a plank than half a dozen foreigners? He would be a very sanguine Briton who would say none of these considerations enter into the popular estimate of our superiority; although some have a capacity for burying their heads, that could hardly be beaten if they had been hatched out on an ostrich farm.

It is, however, to the leaders rather than the rank and file that we must look to keep our end up in the industrial rivalry of nations that is advancing on us with giant strides. The men are what the masters make them, and if a bad system has grown up in the workshop, it is because employers had not foresight and energy to check it at its birth. There are several reasons for this laxity; a prominent one, that employers have too much neglected the workshop for the counting house. It is the natural result of the big combinations to which manufacturing establishments now tend, and has other bad effects than slackness in the workshop. A group of partners, two or three, divide the management of a business between them, one taking the workshop, another the office, and another the counting house; all working strenuously together, planning, thinking, and venturing, each for his own benefit, and, incidentally, for the benefit of his partners. The master's eye, and, still more the master's thought, are the chief things that enter into the composition of a piece of mechanical work. In engineering there is no finality; there is always a chance for something better; and unless one is ever thinking of what the next better thing will be, some one else is sure to think first. That the better thing may be entirely different from that which preceded it—a gas engine instead of a steam engine, or an electric motor in place of a gas engine—is only a stronger reason for watchfulness.

Concentration—or, as it is more often called specialization—is the first need for successful intellectual effort, and the evolution of mechanical designs is essentially intellectual. A good many heads of engineering works consider they may profitably leave such matters of detail to subordinates, to draughtsmen or foremen, and devote themselves to the more engrossing subjects of finance and the selling of products of the works. It would, of course, be foolish to undervalue the importance of the commercial department of an engineering establishment; but certainly the surest means of commanding sales is to produce the best article of its kind at the cheapest rate. This cannot be accomplished without the high standard of productive capacity, which can be evolved by the engineer alone. Moreover, it is only the man in the center of information who can be expected to foresee the

tendency of demand and the shifting channels of trade, due to the progress of invention or to other causes.

It may be thought unnecessary to insist on the need for engineering talent, and for the supremacy of engineering construction in the conduct of an engineering business; but our experience of modern ways in this country is that the engineer is more and more giving way to the commercial man. We need hardly say that the engineer must not be a pedant or a mechanical crank, blind to everything but the working out of problems in design that may or may not have commercial utility. All we advance is that the first necessity for the creation of a successful engineering works is that it should be run on sound and progressive engineering principles. To attain that end, it is needful the organizer should be chiefly thoughtful of his product and the means of production.

The modern large establishments owned by joint stock companies do much to increase the total of engineering enterprise, but they have the effect of putting the engineer in the background. The policy of a big limited liability company becomes so complicated, there are so many interests involved, that those things which should be the first consideration of the management, the technical or engineering details, are relegated to a secondary position. This is apt to lead to want of enterprise, to stagnation and final decay. The fact is not only true of public companies, but also of private firms in which a large share of the proprietorship descends by inheritance; perhaps to ladies, or to the military officers, professional men and country magnates which the sons of successful manufacturers so often become. The interests of these persons are generally looked after by lawyers or accountants, who exercise a controlling influence in the management. It is the principle of these purely business controllers to require that all outlay shall be justified by figures. Thay will not sanction investment of capital in new plant or new inventions, until a profitable return can be shown "in black and white." The engineer, on the other hand, has the knowledge and the foresight that come of his training, and which enable him to give due value to advantages he can plainly foresee, but which he cannot prove in detail on balance sheet principles. The engineer has courage to risk wisely; the mere business man will take as few chances as possible, and sanctions new departures with misgiving. Hence, one often sees old firms with a great reputation behind them, dropping back in the race, passed by younger establishments which have an engineer as their ruling spirit.

Another reason of a different nature why limited liability companies fall short of what might be expected from them through their capital and resources, is the greediness of the average stockholder for immediate returns. Many small investors depend on dividends for the income that buys the necessaries of existence. To them the loss of a year's income involves hardship that can hardly be compensated by promises for the future, however brilliant. Beyond this, a large number may be only temporary holders of stock and object to any large sum being put aside for contingencies that will arise when they have been succeeded by others. The price of shares is largely governed by dividends, and a man naturally dislikes seeing his property depreciate. That is an instinctive feeling, even with those who have sufficient knowledge to prompt them that the provision being made is a wise one. But that knowledge is rare, for the stockholder must not only be, for the purpose, an engineer, but must have some acquaintance with the working of the business.

Another matter in which the private engineer owner holds an advantage over the impersonal company executive is in the good management of the men. We think—and the conclusion is the result of personal observation—that the engineering employers of the United States attach more importance to this undoubted factor of success than we are apt to do in England. The American does not follow this course from philanthropic motives. He rightly thinks philanthropy and business should be kept apart; but he is wise enough to know that well paid employees, with hope of advancement by merit, are the best workers, and most rapidly bring fortune to those they serve. The need in this country is to raise rather than reduce wages; but to make this possible, the men must turn out proportionately more work.

There are many other details of manufacturing policy to which attention might profitably be turned at this era of change and conventional period of retrospection and resolutions. Most of them, however, have been dealt with in these columns at considerable length. In conclusion, we would remind our readers of the remarkable series of articles we published about a year ago on "American Competition." They were written by some of the foremost men in the industries of that country which is to be our keenest competitor in the markets of the world. They well bear more than once reading.

Coal in 1900.[1]

While the past year has not seen the same world wide activity in all lines of industry that prevailed during 1899, yet in this country, manufacturing and transportation companies have been busy. Abroad there has been a more decided reaction, but wars have not interfered with commerce in spite of the anti foreign uprising in China and continued fighting in South Africa. As a result the consumption of coal, that barometer of industrial progress, has not fallen, but has rather risen, and the output of the world this year undoubtedly exceeds the enormous total of 1899. It is of interest, however, to note that the increase is principally from the United States, and that the total increase in tons from the United States will probably exceed the total increase of all other countries in the world put together. Under such circumstances it is hardly necessary to point out that the United States' position as the greatest coal producing country in the world is now unchallenged, and bids fair to remain so for years to come. Not until the vast coal fields of China are developed on a systematic scale by powerful corporations will there be any danger of this country losing its supremacy. Last year, we were the first to announce, in our annual number, that Great Britain had taken second place as a coal producer. This statement was doubted and indeed contradicted by papers that should have known better, but the final returns amply confirmed our preliminary estimate. This year there is no chance for doubt. The total coal production of the United States exceeds 270,000,000 short tons, while the production of England shows but a trifling increase over last year and will probably not exceed 225,00),000 long tons. There were no strikes or serious interferences with production at the English colleries and the small percentage of gain is therefore very noticeable. The competition of American coal may have affected English export trade somewhat, although owing to the high freight rates from this side and the difficulties attending the introduction of a new fuel, American competition has not been so seriously felt by English mine owners as it will be in a few years when American coals have an established market and colliers, built especially for the foreign trade, are in the employ of the great companies that will control shipments from the Atlantic seaboard.

In Europe the search for new coal fields has continued with little success, though there are reports of recent finds of value in Southeastern Europe. In Western Europe, where coal is most wanted, there has been little new coal found. The French fields may show some extension west, but the great cost of getting out the coal will hinder development. In Germany the extent of the coal fields has been pretty definitely determined, and there have been no discoveries of importance during the year. The explorations in Kent, England, to locate a southeastern extension of the English field have progressed very slowly and it is not likely we shall have definite knowledge of the coal seams there for some time.

Of the great coal producing countries of the world Russia will undoubtedly show an increase for this year, the increase coming mostly from the mines of Donetz Basin in Southwestern Russia. The mines in Poland have worked steadily, but their production does not differ very much from that of 1899. The total production of Russia in 1899 was 14,565,000 metric tons, and for the first half of 1900, 7,806,455 tons. The French output shows a slight percentage of gain. In 1899 the output was 32,933,788 metric tons. Coal has been scarce in France during the whole year, and at its close prices have risen to very high figures, retailing as high as $15 per metric ton at Paris. The small increase in production under such circumstances is remarkable and shows that the French collieries are unable of responding to increased demand. It is not surprising, therefore, that there have been considerable importations of American coal, particularly in Southern France, with a strong probability of these importations increasing. In Belgium mining has been very active with high prices stimulating output, but the mines were producing about to their limit last year and the gain will be slight.

Germany is going through a small industrial crisis and manufacturers find trouble in disposing of their products. This has naturally affected the demand for coal, but owing to the restrictive policy of the German colliery owners, who sell through syndicates which control output in the interest of high prices, the total production for the year has not been materially affected. Parts of Germany have relied for years on importations of coal, principally from England and Belgium, and this year there have been importations from America. The German production in 1899 was 135,824,427 metric tons, and in 1900 is approximately 149,400,000 metric tons. The percentage of in-

1. From *Engineering* and *Mining Journal*.

Coal Production of the United States.

States.	1899. Tons.	1899. Value at Mine. Total.	1899. Value at Mine. Per Ton.	1900. Tons.	1900. Value at Mine. Total.	1900. Value at Mine. Per Ton.
Bituminous:						
Alabama	7,484,763	$7,484,763	$1.00	9,000,000	10,800,000	$1.20
Alaska (*b*)	2,300	12,282	5.34	2,600	14,300	5.50
Arkansas	*a*913,743	1,233,553	1.35	*a*950,000	1,330,000	1.40
California	167,161	430,631	2.58	171,106	468,068	2.74
Colorado	4,747,812	8,308,671	1.75	5,436,490	10,872,980	2.00
Georgia	203,775	183,081	0.90	224,190	202,885	0.91
Illinois	*a*23,434,445	18,443,946	0.78	*a*25,153,929	22,510,360	0.89
Indiana	6,158,224	5,542,402	0.90	7,081,957	7,081,957	1.00
Indian Territory	*a*1,404,442	2,106,663	1.50	*a*1,900,127	3,135,209	1.65
Iowa	4,675,000	5,937,350	1.27	4,908,750	6,412,338	1.31
Kansas	4,096,895	5,124,248	1.25	4,100.000	5,125,000	1.25
Kentucky	4,658,800	3,720,100	0.80	5,000,000	3,879,425	0.78
Maryland	5,080,248	4,318,211	0.85	3,900,000	4,173,000	1.07
Michigan	500,000	720,000	1.44	950,000	1,377,500	1.45
Missouri	*a*3,191,811	3,582,111	1.12	*a*2,995,022	3,643,975	1.21
Montana	1,409,882	2,227,998	1.58	1,621,364	2,577,969	1.59
Nebraska (*d*)	1,000	3,000	3.00	900	2,500	2.78
New Mexico (*d*)	*a*1,004,034	1,495,588	1.49	*a*1,145,739	1,722,780	1.50
North Carolina	26,991	37,792	1.40	18,000	22,500	1.25
North Dakota (*b*)	120,591	120,597	1.00	138,000	138,000	1.00
Ohio	16,695,949	14,191,557	0.85	21,704,733	21,270,638	0.98
Oregon	86,886	232,854	2.68	49,560	133,812	2.70
Pennsylvania	73,066,943	57,722,885	0.79	87,680,331	82,419,511	0.94
Tennessee	3,736,134	3,706,617	0.99	4,000,000	4,400,000	1.10
Texas (*c*)	940,622	1,646,088	1.75	1,013,006	1,671,460	1.65
Utah	882,496	1,553,193	1.76	1,281,800	2.448,238	1.91
Virginia	2,111,391	1,372,404	0.65	2,334,295	1,984,151	0.85
Washington (*d*)	1,917,607	3,355,812	1.75	2,175,000	4,893,750	2.25
West Virginia	*a*18,201,189	11,830,773	0.65	*a*21,153,340	14,165,183	0.67
Wyoming	4,525,207	5,656,509	1.25	4,500,000	5,625,000	1.25
Total bituminous — Sh. tons	191,456,350	$172,301,679	$0.90	220,592,239	$224,502,483	$1.02
Total bituminous — Met. tons	173,688,061	.....	0.99	200,119,966	.....	1.12
Cannel:						
Kentucky — Sh. tons	36,639	$91,597	$2.50	25,000	$60.750	$2.43
Kentucky — Met. tons	33,239	.....	2.76	22,680	.....	2.68
Anthracite:						
Colorado	59,067	$162,434	$2.75	59,244	177,732	3.00
New Mexico	*a*45,000	105,000	2.33	*a*41,595	114,385	2.75
Pennsylvania	60,518,331	103,486,346	1.71	54,154,701	96,936,915	1.79
Total anthracite.. Sh. tons	60,622,398	$103,753,780	$1.71	54,255,540	$97,229,032	$1.79
Total anthracite.. Met. tons	54,996,279	.....	1.89	49,220,303	.....	1.97
Grand total coal.. Sh. tons	252,115,387	$276,147,056	$1.10	274,872,770	$321,792,265	$1.17
Grand total coal.. Met. tons	228,717,579	.....	1.21	249,362,949	.....	1.29

(*a*) Fiscal year. (*b*) All lignite. (*c*) One-third lignite. (*d*) One-half lignite.

Coke Production of the United States.

	1899. Tons.	1899. Value at Oven. Total.	1899. Value at Oven. Per Ton.	1900. Tons.	1900. Value at Oven. Total.	1900. Value at Oven. Per Ton.
Alabama	1,798,612	$4,676,391	$2.60	2,150,000	$7,095,000	$3.30
Colorado	455,783	1,253,403	2.75	575,447	1,726,341	3.00
Georgia	44,529	92,748	2.08	48,624	117,026	2.41
Illinois	2,000	3,300	1.65	2,000	3,300	1.65
Indiana	2,105	4,105	1.95	1,249	3,122	2.50
Indian Territory	(*a*) 29,362	95,426	3.25	(*a*) 47,800	191,200	4.00
Kansas	200,000	600,000	3.00	275,000	618,750	2.25
Kentucky	55,580	79,201	1.42	60,000	126,230	2.10
Missouri	4,560	8,803	1.93	2,218	5,641	2.54
Montana	59,072	401,779	6.80	72,500	500,250	6.90
New Mexico	(*a*) 33,661	110,046	3.27	(*a*) 42,803	128,409	3.00
Ohio	73,301	183,477	2.50	47,887	122,591	2.56
Pennsylvania (*c*)	12,192,570	29,871,796	2.45	11,831,593	30,749,662	2.00
Tennessee	490,157	864,073	1.91	498,157	996,314	2.00
Utah	26,700	122,820	4.60	31,000	146,320	4.72
Virginia	555,507	1,027,688	1.85	588,831	1,142,332	1.94
Washington	31,281	117,311	3.75	38,416	178,634	4.65
West Virginia (*b*)	(*a*) 2,058,378	2,580,175	1.25	(*a*) 2,598,847	4,547,982	1.75
Wyoming	15,979	55,926	3.50	16,000	57,280	3.58
Total coke — Sh. tons	18,079,229	$42,148,468	$2.33	18,928,372	$48,456,384	$2.56
Total coke — Met. tons	16,401,369	.....	2.57	17,171,706	.....	2.82

(*a*) Fiscal year. (*b*) Includes 40,537 tons made in Wisconsin in 1899, and 38,000 tons in 1900; also 53,973 tons made in Virginia in 1899, and 64,740 tons in 1900. (*c*) Includes 4,800 tons made in Wisconsin in 1900.

crease in the output of the lignite mines is noticeable, being nearly 20 per cent.

As we have noted, production in England has not been hindered by strikes, and there has been a good demand in France and a fair one in Germany for English coal, although exports to other countries, notably South America, have felt American competition more severely. The English iron industry, like that of this country and of Germany, has seen a reaction from the high prices of 1899, and consequently the demand for fuel from the great manufacturing centers of the north of England and Scotland has not been as heavy as last year. In spite of this the price of coal during the greater part of the year has been high enough to give every inducement to colliery owners and the comparatively small increase in production is therefore noticeable. The Welsh mines, which supply the export trade, have doubtless felt American competition somewhat, and have also been affected by military operations in South Africa and China, which removed from regular service a large fleet of steamers which, if employed in trade, would have used more coal.

Austria Hungary shows a decrease in output, due to a bitter and prolonged strike in the Bohemian brown coal fields, which affected coal mining all over Upper Austria and Moravia. The strike resulted in some advantage to the miners, but the reduction of output made coal high in Austria during the year and greatly stimulated shipments of American coal to Trieste.

In Asia there has been far less work done in opening new fields than was promised a year ago. The Russian Government has done considerable work in Central Siberia along the line of the Trans-Siberian Railroad, and also in Eastern Siberia at the mines on the Island of Saghalien and west of Vladivostok. All industrial activity, however, in Eastern Asia has been more or less at a standstill during the last half of the year on account of the situation in China. In that country, where wretched government has prevented the development of great natural resources, an uprising against foreigners has completely stopped whatever mining operations were under way in the disturbed provinces and interfered with industry generally. The Japanese mines have found their product in demand throughout the year, and undoubtedly show a gain. These mines are being opened and equipped with the best mining devices and after most approved modern practice. They are the largest producers in the East.

In the Australian colonies production has been heavy, though probably not much in excess of that of last year owing to the difficulty the operators have had in getting a supply of miners. In the principal coal producing colony, New South Wales, the miners' union is virtually in control of the industry and its restrictions are frequently burdensome and prevent the output from increasing in response to increased demand.

In Africa, though the British forces have occupied the capitals of the Free State and the Transvaal, the Boer forces still in the field have made it impossible for the Witwatersrand gold mines to resume, and indeed in practically all South Africa military exigencies govern and commerce and manufacturing must wait. Some of the mines supplying the railroads have been worked by the British forces, but otherwise coal production has amounted to nothing.

Coming to the Western Hemisphere, South America maintains its inert attitude. There are good deposits of coal known in Peru and in Colombia, but there is no probability of these deposits being developed through native inception. In the Argentine Republic, where foreign blood predominates, and in Chili, industrial activity continues and the output of coal will doubtless show a gain.

In North America, outside of the United States, there have been practically no important new developments during the year, though projects already started have met with success. The colleries and coke ovens at Fernie, B. C., that started work last year, have found a ready market for their total output among the miners and smelters in surrounding districts, and the plant is to be further enlarged while new collieries will probably be opened in the same region. The coal mines on Vancouver Island, and on the west coast, owing to the Alaskan trade, and the general increase in shipping from Pacific Coast ports, have had an excellent year and their output shows a substantial increase. In the Northwest Territory some fair grade lignite beds have been opened near Dawson. The demand for coal at San Francisco has led to increased imports there of British Columbia coal.

On the Atlantic seaboard the collieries of the Dominion Coal Company on Cape Breton have had a very busy year, and the output of all the Nova Scotia coal mines has been heavy. The Dominion Iron and Steel Company has erected its blast furnaces at Sydney; other similar plants are already projected, and the outlook for Nova Scotia coal mining is most excellent. The local demand for coal has been so heavy during the year as to retard the growing movement to the United States which was so prominent a feature of the 1899 trade; indeed, though receipts of colonial coal at Boston amounted to fully 500,000 tons, during the last months of the year, the New England Gas and Coke Company, a branch of the Dominion Coal Company, made contracts to use West Virginia coal in its by-product coke oven plant at Everett, Mass.

No new developments are reported from Mexico. There have been large sums of money spent in exploring for coal in the Republic, but as yet not with satisfactory results, and the lack of adequate fuel supply is likely to handicap the country's industrial development. The Southern Pacific Railroad has conducted extensive explorations in Sonora, where a limited field of fair quality coal lying in thin beds has been known to exist for some time. The field has never been worked to any extent. In Michoacan and Coahuila other coal deposits are known to exist, but the coal, while if anything of better quality than in Sonora, lies in such uneven and pockety beds as to make its development under present conditions unprofitable.

In Alaska seams of lignite have been opened on the Yukon and along the coast, but their production during the year was slight.

In the United States itself coal mining has gone on with little check. While industrial activity has been less feverish than during 1899, there has been a steady market at profitable figures for all the coal produced and the output this year will probably exceed that of 1899 by fully 20 per cent. There have been some labor disturbances, but only two prolonged strikes, those in the anthracite regions of Pennsylvania and in the George's Creek field in Maryland. The anthracite strike was the largest in the history of this country so far as number of strikers is concerned. The George's Creek strike, while involving a smaller number of men, lasted much longer. In the coal fields of the South and the Southwest and of the Rocky Mountain country there have been few strikes of importance. The total production for the year was 274,872,779 short tons, compared with 252,115,387 short tons in 1899.

Coming to the production by States, we find that Pennsylvania still retains its great pre-eminence in coal mining. Figures received to date indicate for the year a production of 141,835,032 tons, as compared with 133,585,274 short tons in 1899. The advance is wholly from the bituminous fields of the State, as the anthracite region shows a falling off from 60,518,331 short tons in 1899 to about 54,154,701 short tons this year, owing to the strike, which greatly reduced shipments for 2 months. This strike had been impending for some time. In fact it had been threatened for over a year. The United Mine Workers of America, an organization which started in the soft coal fields of the Central West, sought to extend its control over all the eastern coal mines. Its opportunity in the anthracite region came with the great revival of mining in the last months of 1898 and during 1899. With coal selling at better prices and the output increasing, the union organizers found it easy to stir up the men and promote dissatisfaction by stories of low wages and large profits. The miners for years have had grievances, some real, some more or less imaginary, which various organizations among the men from time to time sought to remedy. Practically none of these movements accomplished the ends desired by their organizers, the anthracite coal region being a field governed by unique conditions which have developed with the growth of the industry so that methods and regulations which are general in soft coal regions are out of the question there. After the collapse of the Knights' of Labor attempt to control the anthracite miners in 1887 no serious effort at such control was made until the United Mine Workers started work in the district on a large scale in 1898.

[To be Continued.]

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. OLIVER M. DIALL, of Terre Haute, Ind., has been appointed General Manager of the Macon (Ga.) Gas and Water Company.

THE following is the new rate schedule announced by the proprietors of the Danvers (Mass.) Gas Light Company—the net rates are conditioned upon the payment of bills in 15 days:

Consumption per Month.	Net Rate per 1,000.
Under 1,000 cubic feet	$2.16
1,000 cubic feet to 6,000 cubic feet	1.98
Over 6,000 cubic feet	1.80

DURING the last week in last December Coroner Dugan, of Philadelphia, came into the possessions of a man named Richard Thomas, of

that city, who had committed suicide through having inhaled illuminating gas. In searching the clothing of the deceased a letter was found, directed to the "Philadelphia Gas Company," the lines of which were as follows: "Enclosed you will find $1, the same to pay for the gas I have used to end my life. All of the above amount remaining after the cost of the gas is deducted is to be given to the gas inspector as a small Christmas gift from me."

IT is reported that the Mason City (Ia.) gas, electric lighting and street railway interests have been purchased by Mr. W. E. Brice and his associates.

THE proprietors of the Hazelton (Pa.) Gas Company have refused the terms offered for the purchase of the plant by a New York city "syndicate."

MR. CLARKSON CATES, originally well known to the gas industry through his management of the Muncie (Ind.) Natural Gas Company's plant, died in Muncie, Ind., the afternoon of the 2d inst. He was a veteran of the War of the Rebellion, and was very well known and respected in the State of Indiana.

AT the annual meeting of the New Haven (Conn.) Gas Light Company the Directors chosen were: Messrs. Charles R. Ingersoll, George J. Brush, Francis Wayland, E. Hayes Trowbridge, Pierce N. Welch, George D. Watrous, Robert A. Brown, T. Attwater Barnes and Chas. H. Nettleton. At the organization meeting the Directors selected the following executive officers: President, Charles H. Nettleton; Vice-President, Pierce N. Welch; Secretary, Gardner Morse; Treasurer, Isaac J. Wild.

THE authorities of Frankfort, Ky., propose to take over the plant of the Frankfort Gas Company for operation on public account.

MR. ROBERT W. ELLIOTT, General Manager of the Hudson County (N. J.) Gas Company, has resigned that position. His temporary successor is Mr. Percy S. Young, who had been Assistant Manager to the Company, and it is the hope of many, in which hope we share, that Mr. Young will receive the permanent appointment.

THE projected gas plant for Great Falls, Mont., is said to be a certainty, and that construction work thereon will be started by February 1st.

THE gas supply of La Grange, Ills., will be laid on by March 1st, if not before.

THE public health manipulators of the Borough of Brooklyn, N. Y., are showing unwonted activity respecting the purification of Gowanus Canal. There is only one way to "purify" the Canal, and that is by filling it up. However, if it is to remain open, and if there is anything of virtue in antiseptic treatment, instead of the authorities declaring that the drip from the Fulton Municipal branch works of the Brooklyn Union Gas Company into the Canal is objectionable or prejudicial to public health—and that is the very thing the authorities are saying—they should ask the Company not only to keep on but increase its good work in the antiseptic line.

"W. F. S." is informed that the main features of the bill put before the New York Legislature, by Senator Donnelly, respecting his proposal to engage the city of New York in the manufacture and distribution of gas on public account, differ but little from those of the measure proposed by him on similar lines last year. Briefly stated, the measure authorizes and directs the city to establish a plant for the supply of gas to New York city and its inhabitants, the maximum rate for such supply to be not in excess of 75 cents per 1,000 cubic feet. The city is empowered to acquire land under or above water, and to acquire existing gas works and distributing systems, subject to and governed by terms approved by the Board of Estimate and Apportionment. Condemnation proceedings may be brought if title cannot be acquired any other way. The Commissioner of Public Buildings, Lighting and Supplies is to establish the system. The Corporation Council is to institute proceedings to obtain all lands or other systems required. The City Controller is directed to issue corporate stock necessary to provide for the cost of establishing the plant.

MR. A. C. SWAIN has been appointed resident engineer of the gas plant at Kankakee, Ills., which property we noted recently came into the possession of Messrs. Street, Wyckes & Co., of this city.

ARTICLES incorporating the Ossining Heat, Light and Power Company were filed in the office of the County Clerk, of Westchester, N. Y. Its stated objects are the manufacture and supply of gas for light, heat and power, in Sing Sing and Croton, N. Y., and the manufacture and distribution of electric currents for the purposes named. The capital stock is put at $250,000, and the term of its existence is put at 50 years. The reported Directors are John B. Summerfield and Ansel White, of Brooklyn, and James Murray Mitchell, of New York city.

THE Fond du Lac (Wis.) Street Railway and Light Company has moved into spacious and well fitted offices, at No. 9 Rees street, that city. The Company's affairs are moving along smoothly and satisfactorily.

WE understand that the gas, electric light and water properties of Hot Springs, Ark., are to be taken over by a local syndicate, prominent in which are the owners of the Arlington and Eastman hotels.

WE regret to report the death, at Omaha, Neb., on the morning of December 31st, of Mr. James Gilbert, who since 1882 had acceptably filled the position of City Gas Inspector for Omaha. We hope in time to give some record of his life.

THE electric plant of the Texarkana (Texas) Gas and Electric Light Company was badly injured by fire the latter part of December. The gas plant was not injured. The loss sustained was fully covered by the insurance carried.

THE Common Council of Philadelphia has confirmed the bill under which the sale of the old gas works property, extending from 23d street to the Schuylkill river, and Market to Filbert street, was made to Mr. Charles H. Banner, attorney. The sale, which took place June 7, 1900, was at public auction, and the successful bid was $465,000.

IT is said that P. B. Shaw, of Williamsport, Pa., has secured a controlling interest in the Lancaster Gas Light and Fuel Company and in the Edison Electric Illuminating Company, of Lancaster. It is also said that he is willing to buy the outstanding stock in the named Companies, at the rate of $60 per share for the former and $10 per share for the latter.

THE following facts are from the report submitted by the Superintendent of the Richmond (Va.) City Gas Works (Mr. W. P. Knowles) respecting the operation of that plant for the year ended December 31, 1900:

Month.	Gas Made, Cu. Ft.	Gas Used, Cu. Ft.
January	31,808,000	31,789,563
February	27,019,500	27,023,731
March	25,597,600	25,587,376
April	20,207,000	20,203,634
May	18,312,500	18,306,111
June	14,910,100	14,887,853
July	13,309,300	13,440,169
August	13,508,200	13,440,783
September	16,511,800	16,510,785
October	22,553,600	22,559,663
November	26,189,400	26,192,320
December	32,850,000	32,825,950
Total	262,777,000	262,767,938

This shows a percentage gain of output amounting to 8.1, as between 1899 and 1900. The weight of coal used was 9,262 tons; coke used, 10,787,500 pounds; oil used, 587,540 gallons. The lime used in purification was 20,918 bushels. Meters in use, 7,437. During the year less than one mile of street main was laid. The total mileage of the latter now in use is 78. During the year 160 new service pipes were laid on.

A CORRESPONDENT in Memphis Tenn., writing under date of January 5th, says: "On the first of the year there went into effect a 5 cent reduction per 1,000 cubic feet in the price of gas, the rate for an illuminating supply being cut to $1.40, the fuel rate going to $1.15. These reductions are due to the increase in the consumption of gas in this city for they year just ended. Under the ordinance passed December 29, 1899, the Equitable Gas Light Company and the New Memphis Gas Light Company were allowed to consolidate on certain conditions. The ordinance presented certain fixed prices for succeeding years. Under this section of the ordinance the rate for 1900 would be

(*Concluded on page* 54.)

THE AMERICAN GAS LIGHT JOURNAL

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England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JANUARY 14, 1901.

(*Continued from page* 53.)

$1.48 and $1.23. For 1901 the rates would be $1.46 and $1.21. But there was also another section of the ordinance which made the combined annual consumption govern the cost of gas to the consumers. The consumption section last and this year regulated the prescribed rates for years. The consumption for 1899 exceeded 110,000,000 cubic feet, and in consequence the price was reduced 5 cents on both fuel and illuminating gas, instead of 2 cents, as it would otherwise have been. During 1900 the consumption mark rose about 13,000,000 cubic feet, and the cost came down another 5 cents. At the office of the Company it was roughly stated that the consumption for 1900 would aggregate 126,000,000 cubic feet. As shown by the tables made in the ordinance there would have been a decrease in the price as each year went by, but not so great a reduction as that by reason of the consumption. The specified rates for years was made as follows :

	Illuminating. 1,000 Cu. Ft.	Fuel. 1,000 Cu. Ft.
1899.....	$1.50	$1.25
1900.....	1.48	1.23
1901.....	1.46	1.21
1902.....	1.44	1.19
1903.....	1.42	1.17
1904.....	1.40	1.15
1905.....	1.38	1.13
1906.....	1.36	1.11
1907.....	1.34	1.09
1908.....	1.25	1.00

"But the ordinance continued as follows: If at any time during the 20 years, commencing January 1, 1899, the combined annual sales of illuminating and fuel gas sold by said two Gas Companies and any successor or purchaser for them, as ascertained by consumers' meters, aggregate the following amounts, the following prices shall be charged, namely :

Feet.	Illuminating Gas.	Fuel Gas.
110,000,000.....	$1.45	$1.20
120,000,000.....	1.40	1.15
130,000,000.....	1.35	1.10
140,000,000.....	1.30	1.05
150,000,000.....	1.25	1.00
160,000,000.....	1.20	1.00
170,000,000.....	1.15	1.00
180,000,000.....	1.10	1.00
190,000,000.....	1.05	1.00
200,000,000.....	1.00	1.00

"If the rates prescribed for the years had been alone adopted, Memphis would have reached the present price of gas in 1904."

GENERAL BENJAMIN HARRISON has been elected to the management of the Consumers Gas Trust Company, of Indianapolis, Ind. He serves it in the position of a Trustee.

THE Eau Claire (Wis.) Gas Light Company's new works will be located at the junction of the Eau Claire and Chippewa rivers. The expenditure on construction account will not be less than $50,000. The officers of the Company are : President, David Douglas ; Vice-President, D. Drummond ; Secretary and Treasurer, C. Luebkeman.

A RECENT issue of the Kansas City (Mo.) *Journal* had this to say : "The Kansas City, Missouri, Gas Company, during the year 1900, made satisfactory progress and reports gains in business corresponding with the growth of the city. The requirements as to candle power and quality of gas furnished consumers and the city have been exceeded, as shown by the records of the city gas inspector's office. During the past year the Company laid new distributing mains and made numerous extensions, aggregating over 6 miles to reach new territory and secure new business. The total number of meters in use now exceeds 20,000, while 18,000 gas ranges and appliances are loaned to consumers, and the liberal methods adopted by the Company—free gas service and free gas stoves—will be continued for the coming, as has been done during the past years. Over 1,000 new services have been run and 150 new city lamps and lamp posts erected, besides improvements and betterments at the works which have added much to the efficiency of the plant. The city has been paid the 2 per cent. on gross receipts from sales of gas—over $14,000—for the current year. Many extensions of mains and improvements are under consideration for the coming year. The Company may be depended upon to keep pace with the growth of the city and to fulfill its obligations as a public service corporation."

A CORRRSPONDENT incloses the following, under date of the 8th inst.: "The annual meeting of the Lebanon Gas Company, for reorganization for 1901, took place yesterday afternoon in the office of the Treasurer, Maj. John W. Mish, No. 9 South 9th street. The 7 members elected as the Board of Managers are : Anthony Arentz, H. C. Grittinger, Cornwall ; Charles H. Killinger, Esq., L. E. Weimer, Rudolph Behm, Palmyra ; Gen. J. P. S. Gobin and Maj. John W. Mish. The Managers subsequently organized by electing these officers : L. E. Weimer, President ; H. C. Grittinger, Vice-President ; John W. Mish, Secretary and Treasurer ; Charles H. Killinger, Solicitor. The Company declared a semi annual dividend of 4 per cent., payable January 14. The Treasurer will be in his office, 9 South 9th street, from 9:30 to 4:30 from January 14 to 18 to meet all who are entitled to their share of the dividends. Maj. Mish, re-elected Secretary and Treasurer of the Company has rendered efficient service to his colleagues for 45 consecutive years. When the Company was organized 45 years ago, Maj. Mish was elected to the office he now holds, and he has faithfully served it ever since.

THE Spokane Falls (Wash.) Gas Light Company has arranged for the construction of an ammonia plant.

AT the annual meeting of the Bristol (R. I.) County Gas and Electric Company, the following Directors were elected : S. P. Colt, Marsden J. Perry, W. T. P. Wardwell, J. Howard Manchester, S. B. Peck and D. A. Pierce.

The Market for Gas Securities.

The market for city gas shares was dull but exceptionally strong, particularly towards the close of the week. The net gain in the trading since last time of writing was 3 points, the closing bid price to-day (Friday) for Consolidated being 195.

Other city shares show no particular change, although we imagine not many shares of Standard or Mutual could be bought at our quoted figures. A feature of the local trading for the week was a sharp spurt in New Amsterdam 5's, for which 109½ is bid.

Brooklyn Union is steady or better,, and it is cheap at the quoted rates. Peoples, of Chicago, maintains its recent advance fairly well, and its increase in quoted value will likely hereafter be comparatively slow, since the Ogden settlement seems to have been discounted.

Baltimore Consolidated is 59 to 60, and Washington (D. C.) has climbed to 319 bid. Lacledes are seemingly unaffected by the talked of opposition for that city. The latter, we think, will not amount to much.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JANUARY 14.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated.....	$54,595,200	100	194½	195
Central Union, Bonds, 5's.	3,000,000	1,000	108½	109½
Equitable Bonds, 6's.....	1,000,000	1,000	105	..
" 1st Con. 5's.....	2,300,000	1,000	120	..
Metropolitan Bonds.....	658,000	..	108	112
Mutual.....	3,500,000	100	295	299
" Bonds.....	1,500,000	1,000	100	102
Municipal Bonds.....	750,000	..	..	..
New Amsterdam Gas Co...				
Bonds, 5's	11,000,000	1,000	109¼	110
Northern Union, Bonds, 5's.	1,250,000	1,000	104	104½

New York and East River..				
Bonds 1st 5's	3,500,000	1,000	106	106⅜
" 1st Con. 5's	1,500,000	..	115	.
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	131	133
Preferred	5,000,000	100	151	153
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	114
Yonkers	299,600	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	176	180
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1¼	1⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	30	40
" 1st Mtg. 5's	503,000	1,000	96½	99½
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	7	9
" " Bonds, 5's	5,250,000	1,000	68	71
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati G. & C. Co.	8,500,000	100	194	198
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,622,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore	11,000,000	100	59	60
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	16
" Con. Mtg. 5's	380,000	1,000	80	85
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	95	97
" Prior Lien 5's	4,737,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	100	101
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	35	40
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co.	1,000,000	50	100	105
" 1st Mtg. 5's	1,225,000	1,000	..	..
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	50	60
" Bonds, 6's	2 650,000	..	89	93
Jackson Gas Co	250,000	50	70	75
" 1st Mtg. 5's	265,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,822,000	1,000	101½	103
Laclede, St. Louis	8,271,000	100	70	74
Preferred	2,500,000	100	97	100
Bonds	10,000,000	1,000	107	107⅛
Lafayette Gas Co., Ind.	1,000,000	100	40	50
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.	400,000	100	62	66
" 1st Mtg. 6's	350,000	1,000	102½	105
" 6 per cent. scrip, due 1901	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	101
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	104⅜	104½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	90¾	91
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	47¼	47½
St. Paul Gas Light Co.	1,500,000	100	47	50
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,465,000	1,000	88	90¼
St. Joseph Gas Co	1,000,000	100	31	34
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	9	11
Bonds	1,612 000	1,000	88½	93
Washington, D. C	2,600,000	20	318	318¼
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	97	99
Bonds, 5's	3,830,500	..	107	107½
Wilmington, Del.	600,000	50	200	201

Advertisers' Index.

GAS ENGINEERS. Page

Wm. Henry White, New York City 75
Fred. Bredel, Milwaukee, Wis. 62
Geo. R. Rowland, New York City 71
The Western Gas Construction Co., Fort Wayne, Ind. 80
Humphreys & Glasgow, New York City 71
American Gas Co., Phila., Pa. 62
David Leavitt Hough, New York City 72
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 59
Baxter & Young, Detroit, Mich. 72
United Gas Improvement Co., Phila., Pa. 67
James T. Lynn, Detroit, Mich. 72
A. E. Boardman, Brevard, N. C. 72

GAS WORKS APPARATUS AND CONSTRUCTION.

Continental Iron Works, Brooklyn, N. Y. 74
Deily & Fowler, Phila., Pa. 76
Kerr Murray Mfg. Co., Fort Wayne, Ind. 72
Stacey Mfg. Co., Cincinnati, Ohio. 75
Bartlett, Hayward & Co., Baltimore, Md. 73
Davis and Farnum Mfg. Co., Waltham, Mass. 72
R. D. Wood & Co., Phila., Pa. 74
Isbell-Porter Company, New York City 74
Fred. Bredel, Milwaukee, Wis. 62
United Gas Improvement Co., Phila., Pa. 67
National Gas and Water Co., Chicago, Ills 69
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 59
The Western Gas Construction Co., Fort Wayne, Ind. 80
Humphreys & Glasgow, New York City 73
American Gas Co., Phila., Pa. 62
Logan Iron Works, Brooklyn, N. Y. 76
Riter-Conley Mfg. Co., Pittsburgh, Pa. 75
Baxter & Young, Detroit, Mich. 72
American Bridge Co., New York City 58
G. Shepard Page's Sons, New York City 72
James T. Lynn, Detroit, Mich. 72
A. E. Boardman, Brevard, N. C. 72
Sutherland Construction & Improvement Co., N.Y. City 59
Chris. Cunningham & Son, Brooklyn, N.Y. 64

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. 73
United Gas Improvement Co., Phila., Pa. 67
Burdett Loomis, Hartford, Conn. 74
National Gas and Water Co., Chicago, Ills. 69
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 59
The Western Gas Construction Co., Fort Wayne, Ind. 80
Humphreys & Glasgow, New York City 74
Sutherland Construction & Improvement Co., N.Y. City 59
B. E. Chollar, St. Louis, Mo. 58

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa. 74
Continental Iron Works, Brooklyn, N. Y. 74
Logan Iron Works, Brooklyn, N. Y. 76
Riter-Conley Mfg. Co., Pittsburgh, Pa. 75

TAR AND CARBONIC ACID EXTRACTOR.

R. D. Wood & Co., Phila., Pa. 74

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich. 56
American Gas Company, Phila., Pa. 62

GAS METERS.

John J. Griffin & Co., Phila., Pa. 40
American Meter Co., New York and Philadelphia. 79
Helme & McIlhenny, Phila., Pa. 79
D. McDonald & Co., Albany, N.Y. 77
Nathaniel Tufts Meter Co., Boston, Mass. 78
Maryland Meter and Mfg. Co., Baltimore, Md. 78
Metric Metal Co., Erie, Pa. 79
Keystone Meter Co., Royersford, Pa. 8
Detroit Meter Company, Detroit, Mich. 79

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia. 79
John J. Griffin & Co., Phila., Pa. 40
D. McDonald & Co., Albany, N. Y. 77
Helme & McIlhenny, Phila., Pa. 79
Nathaniel Tufts Meter Co., Boston, Mass. 78

GAS AND WATER PIPES.

M. J. Drummond & Co., New York City 64
R. D. Wood & Co., Phila., Pa. 74
Warren Foundry and Machine Co., New York City 64
Donaldson Iron Co., Emaus, Pa. 64
Chris. Cunningham & Son, Brooklyn, N.Y. 64
Cornell & Underhill, New York City 46

PIPE WRENCHES.

Atlas Pipe Wrench Company, New York City 64

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City 56

GAS TAPPING MACHINES.

George Light, Dayton, O. 56
H. Mueller Manufacturing Company, Decatur, Ills 56

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y. 61

GAS COALS.

Penn Gas Coal 71
Perkins & Co., New York City 70
Despard Gas Coal Co., Baltimore, Md. 71
Westmoreland Coal Co., Phila., Pa. 71
Berwind-White Coal Mining Co., New York and Phila. 70

CANNEL COALS.

Perkins & Co., New York City 70

CONVEYORS.

The Link-Belt Machinery Co., Chicago, Ills. 61

GAS ENRICHERS.

Standard Oil Co., New York City 71
The Sun Oil Co., Pittsburgh, Pa. 71

COKE CRUSHER.

C. M. Keller, Columbus, Ind. 71

GAS GAUGES.

The Bristol Co., Waterbury, Conn. 61

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 69
Isbell-Porter Co., New York City 74
R. D. Wood & Co., Phila., Pa. 74
Wm. M. Crane Co., New York City. 61

CEMENTS.

C. L. Gerould, Galesburg, Ills 68

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J. 68
Adam Weber Sons, New York City 68
Laclede Firebrick Mfg. Co., St. Louis, Mo. 57 68
Cyrus Borgner, Phila., Pa. 68
James Gardner, Jr., Co., Pittsburgh, Pa. 68
Henry Maurer & Son, New York City 68
Baltimore Retort and Firebrick Co., Baltimore, Md. 68
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 68
Brooklyn Firebrick Works, Brooklyn, N. Y. 68
Missouri Firebrick Co., St. Louis, Mo. 68

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md. 73
Fred. Bredel, Milwaukee, Wis. 62
J. H. Gautier & Co., Jersey City, N. J. 68
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 68
Adam Weber Sons, New York City 68
Missouri Firebrick Co., St. Louis, Mo. 68

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City 74
Continental Iron Works, Brooklyn, N.Y. 74
Logan Iron Works, Brooklyn, N. Y. 76
R. D. Wood & Co., Phila., Pa. 74

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City 69

INCANDESCENT GAS LAMPS.

Welsbach Company, Gloucester, N.J. 66
Kern Incandescent Gas Light Co., New York City. 60

BURNERS.

C. A. Gefrorer, Phila., Pa. 74
Wm. M. Crane Co., New York City 21
D. M. Steward Mfg. Co., Chattanooga, Tenn. 61

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn 61

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila. 66
Thos T. W. Miner, New York City 56

PURIFIERS.

Stacey Mfg. Co., Cincinnati, O. 58

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 69

VALVES.

Ludlow Valve Manufacturing Co., Troy, N.Y. 61
R. D. Wood & Co., Phila., Pa. 74
Continental Iron Works, Brooklyn, N. Y. 74
The P. H. & F. M. Roots Co., Connersville, Ind. 61
Isbell-Porter Co., New York City 74
The Western Gas Construction Co., Fort Wayne, Ind. 80
Kerr Murray Mfg. Co., Fort Wayne, Ind. 72

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind..... 63
Isbell-Porter Company, New York City..... 74
Connelly Iron Sponge and Governor Co., New York City 69
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 62

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 75

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City..... 56

PURIFIER SCREENS.

John Cabot, New York City..... 61

GAS STOVES.

American Meter Co., New York and Philadelphia..... 65
Maryland Meter and Manufacturing Co., Baltimore, Md. 78
Keystone Meter Co., Royersford, Pa..... 68
Nathaniel Tufts Meter Co., Boston Mass..... 68

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y..... 73

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 73
Continental Iron Works, Brooklyn, N. Y..... 74
Deily & Fowler, Philadelphia, Pa..... 76
Davis & Farnum Mfg. Co., Waltham, Mass..... 62
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 62
Stacey Mfg. Co., Cincinnati, Ohio..... 75
R. D. Wood & Co., Philadelphia, Pa..... 74
Logan Iron Works, Brooklyn, N. Y..... 76
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 75

STORAGE TANKS.

Chris. Cunningham & Son, Brooklyn, N.Y..... 64

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Henry Marquand & Co., New York City..... 56

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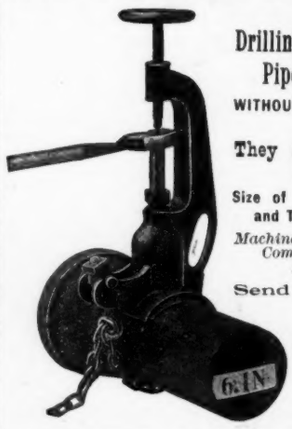

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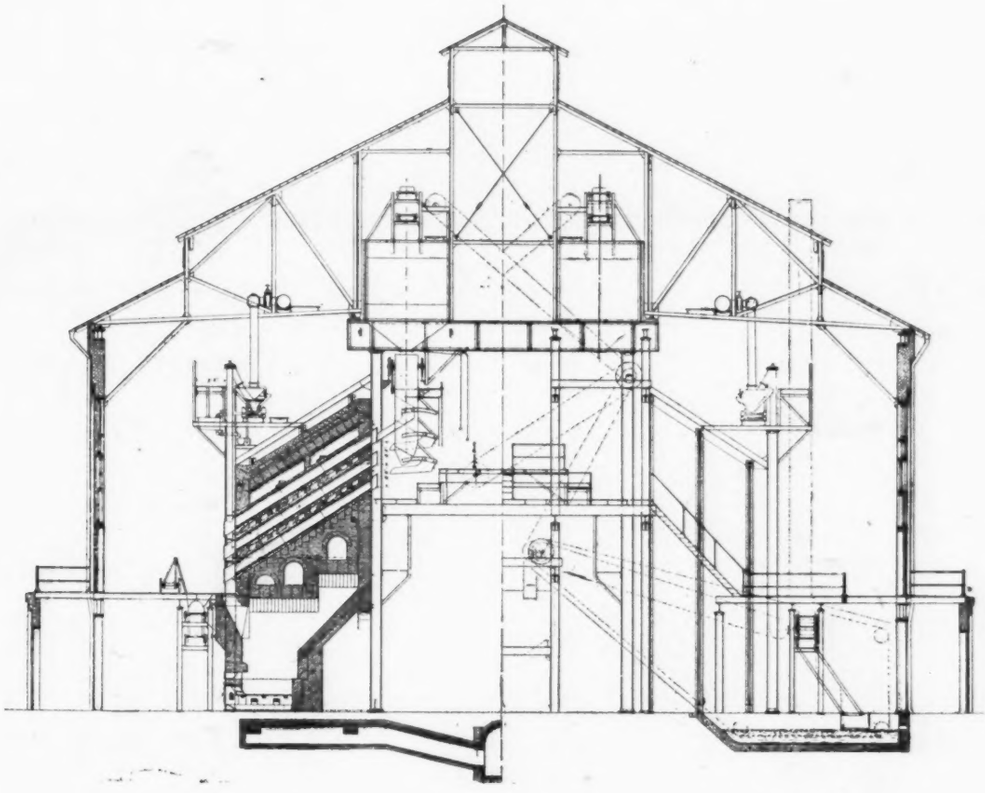

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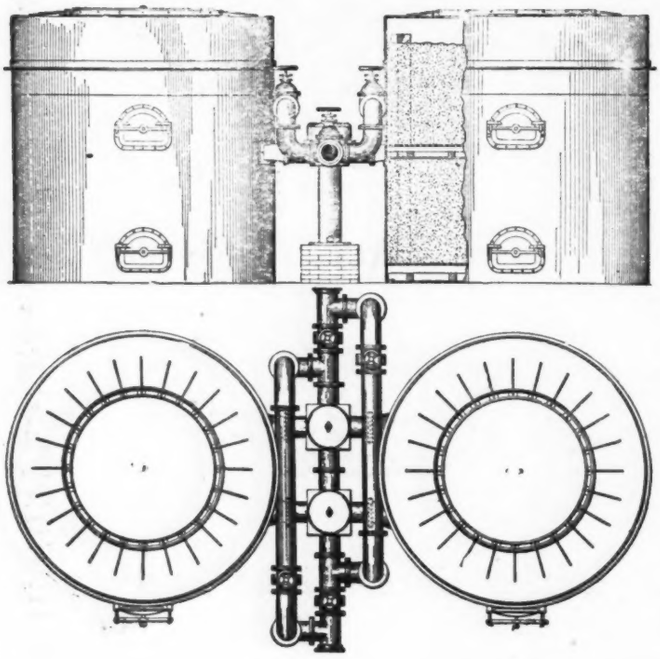

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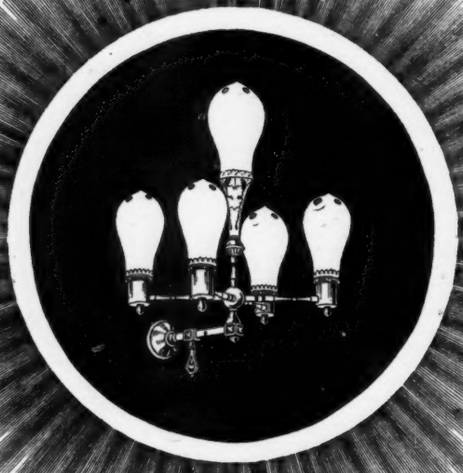

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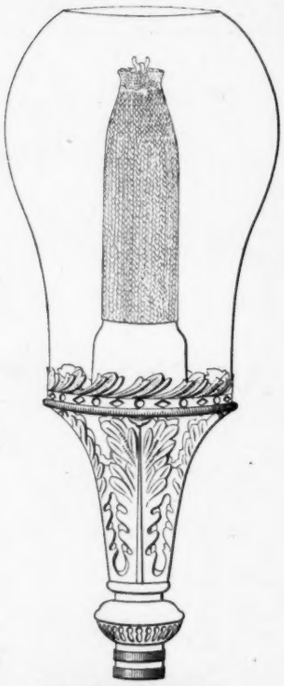

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Burner No.	0	consumes	8-10	cubic foot,	30-candle	power.
"	1	"	1	"	35	"
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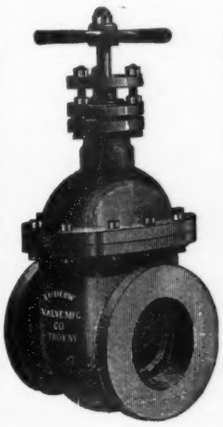

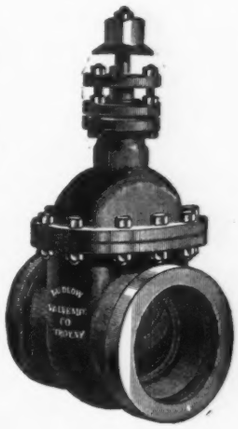

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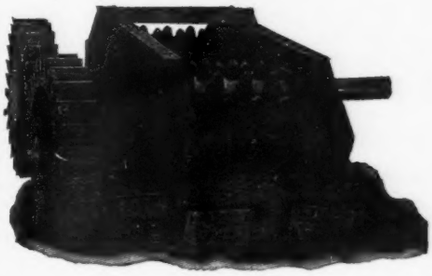

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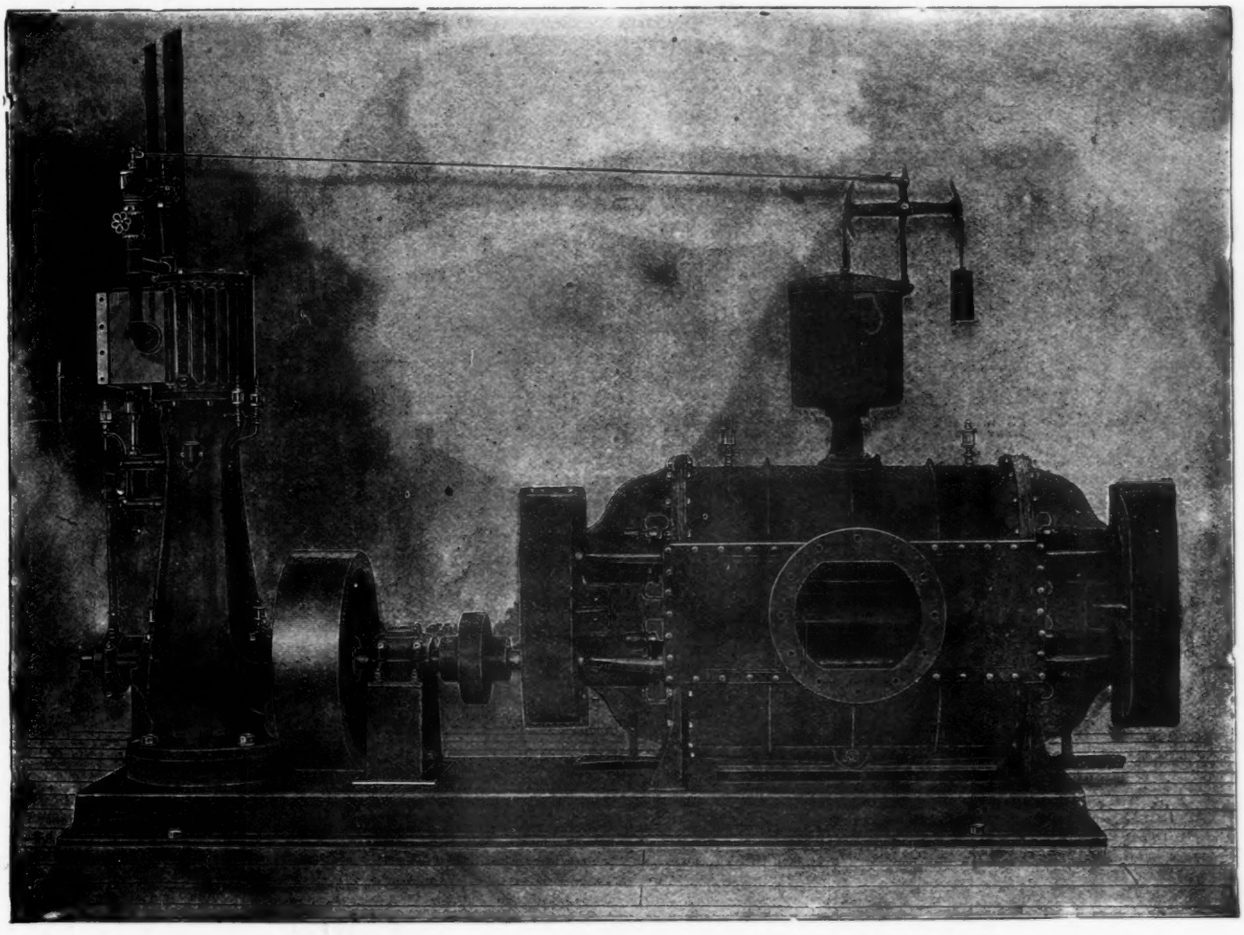

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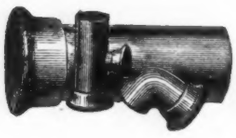

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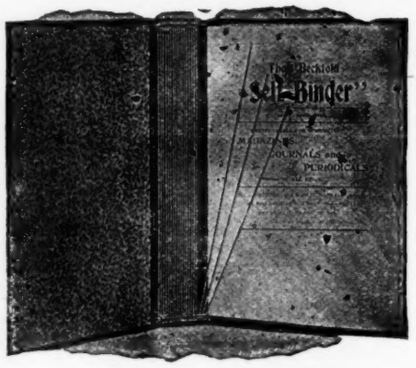

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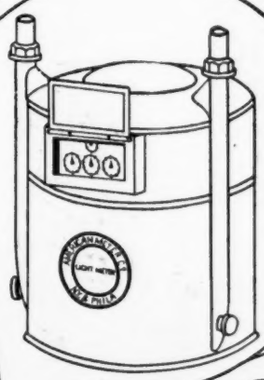

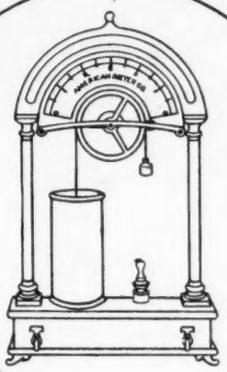

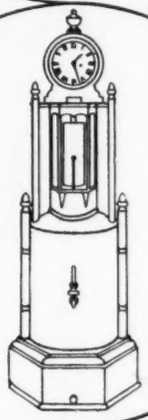

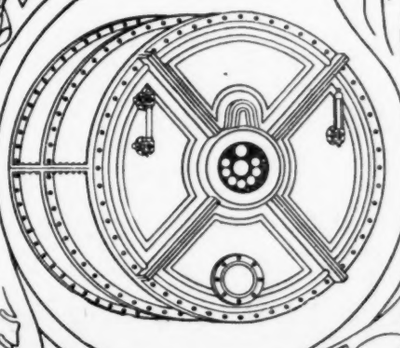

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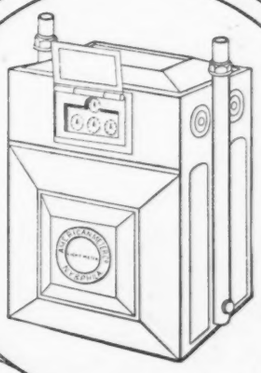
PUBLIC LIGHTING TABLE.

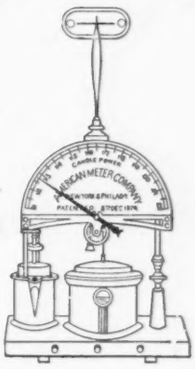
FEBRUARY, 1901.

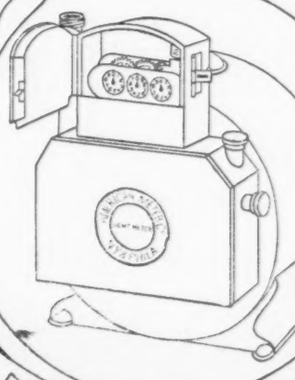
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	5.10 AM	6.10 AM	5.05	6.15
Sat.	2	No L.	No L.	5.05	6.15
Sun.	3	No L. FM	No L.	5.05	6.15
Mon.	4	No L.	No L.	5.05	6.15
Tue.	5	6.00 PM	8.50 PM	5.10	6.10
Wed.	6	6.00	9.40	5.10	6.10
Thu.	7	6.00	10.40	5.10	6.10
Fri.	8	6.00	11.40	5.10	6.10
Sat.	9	6.00	12.30 AM	5.10	6.10
Sun.	10	6.00	1.30	5.10	6.10
Mon.	11	6.00 LQ	2.30	5.10	6.10
Tue.	12	6.00	3.20	5.20	5.55
Wed.	13	6.00	4.10	5.20	5.55
Thu.	14	6.00	5.00	5.20	5.55
Fri.	15	6.00	5.50	5.20	5.55
Sat.	16	6.00	5.50	5.20	5.55
Sun.	17	6.10	5.50	5.20	5.55
Mon.	18	6.10 NM	5.50	5.20	5.55
Tue.	19	6.10	5.50	5.30	5.55
Wed.	20	6.10	5.50	5.30	5.55
Thu.	21	6.10	5.50	5.30	5.55
Fri.	22	6.10	5.50	5.30	5.55
Sat.	23	10.30	5.50	5.30	5.55
Sun.	24	11.40	5.40	5.30	5.55
Mon.	25	12.40 AM FQ	5.40	5.30	5.55
Tue.	26	1.40	5.40	5.30	5.45
Wed.	27	2.30	5.40	5.30	5.45
Thu.	28	3.10	5.40	5.30	5.45

TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45







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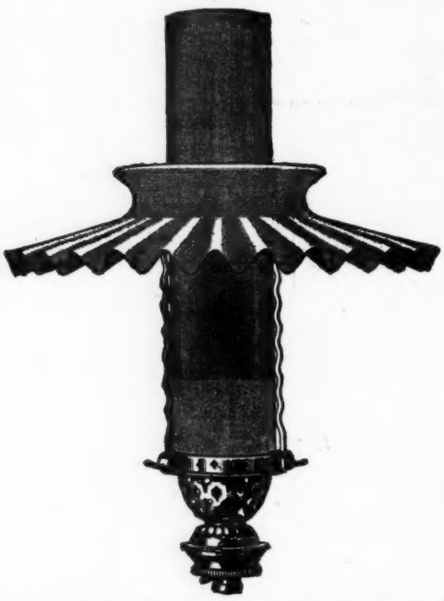

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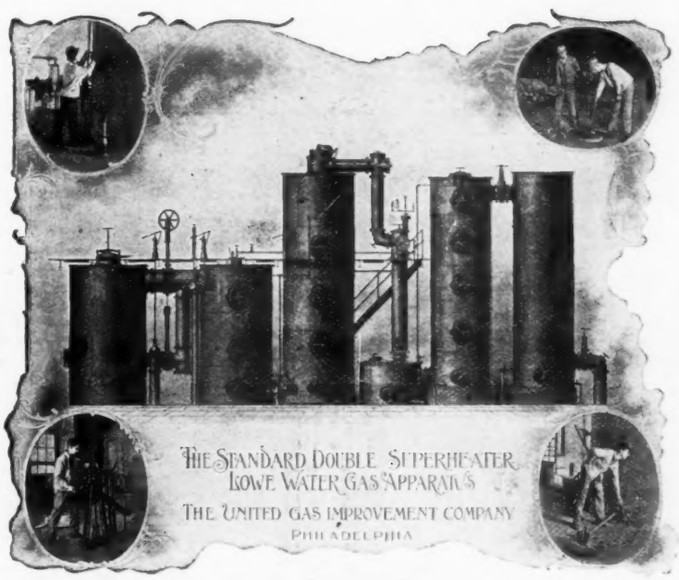
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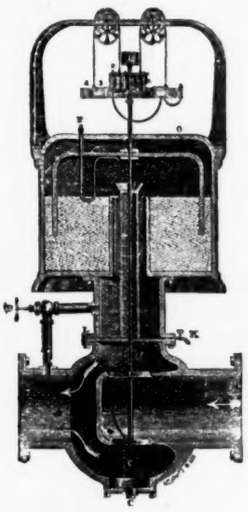

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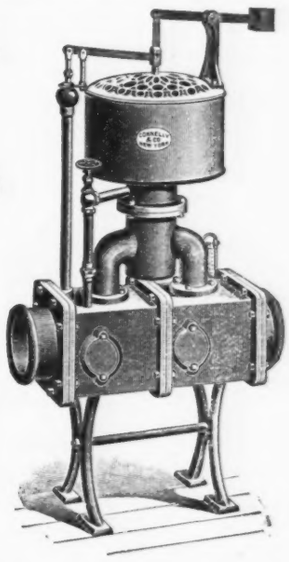

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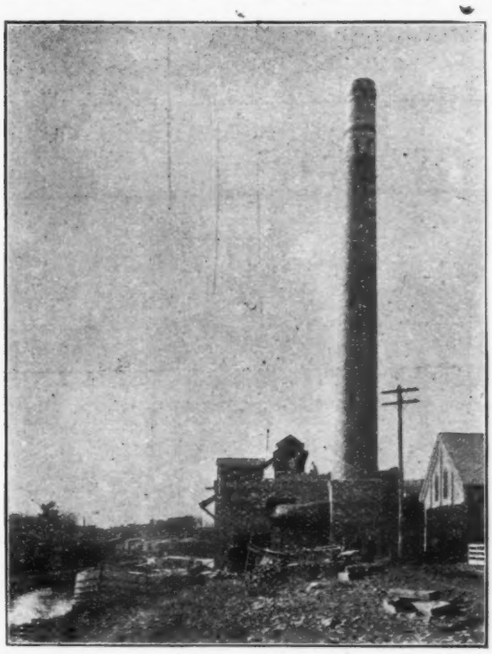

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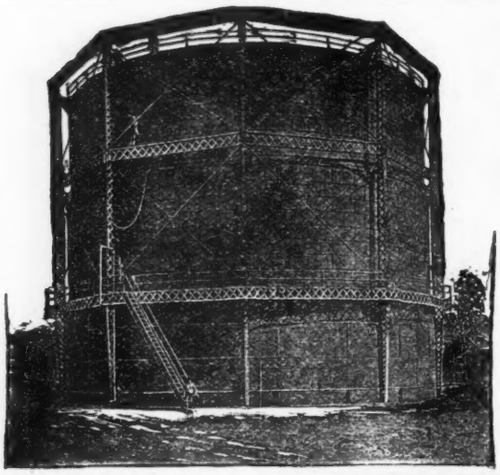

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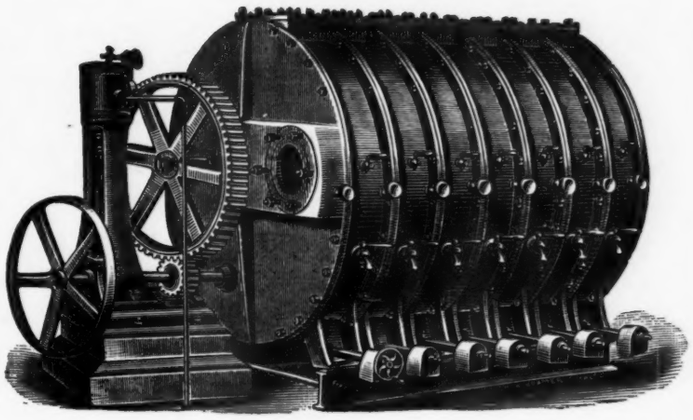

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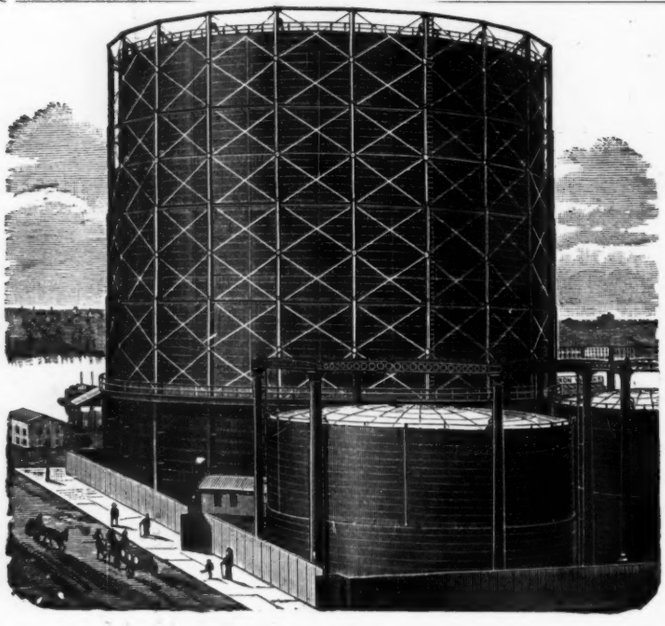

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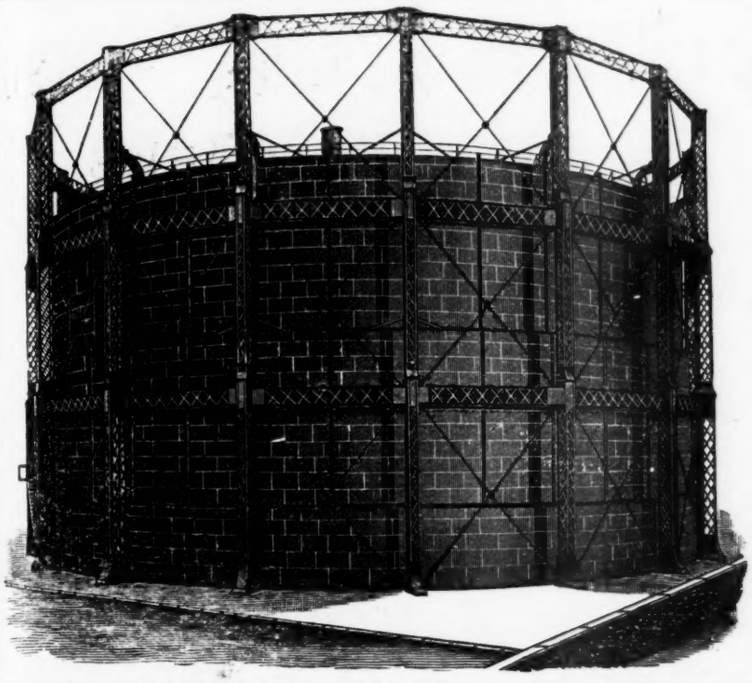

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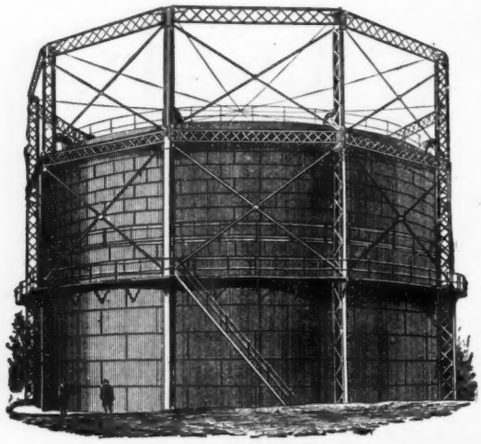

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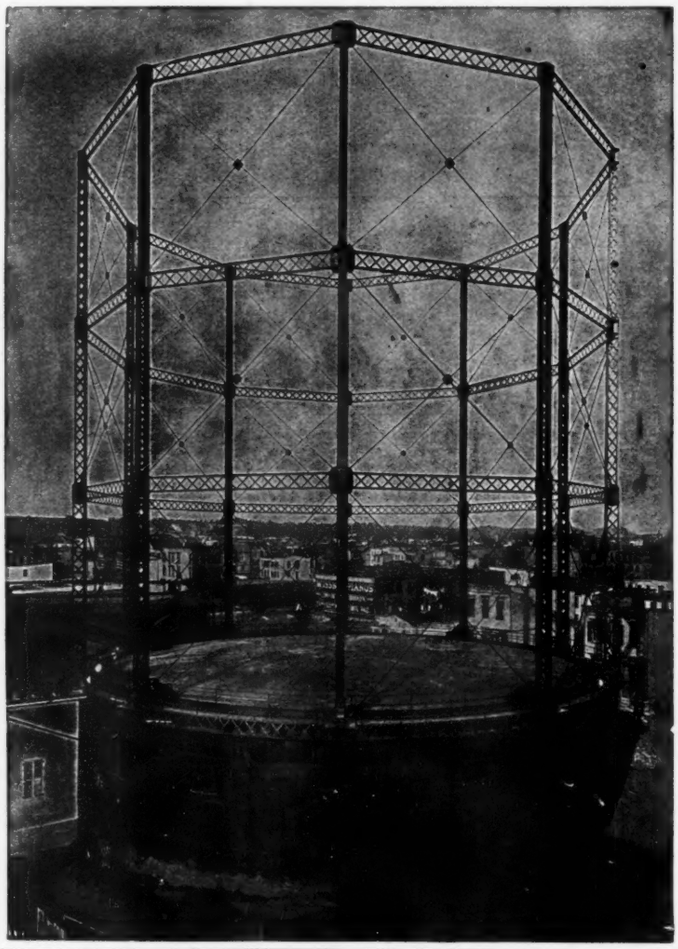

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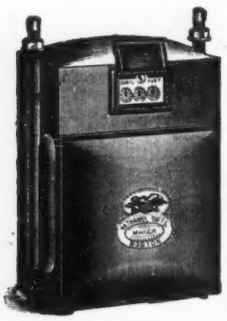

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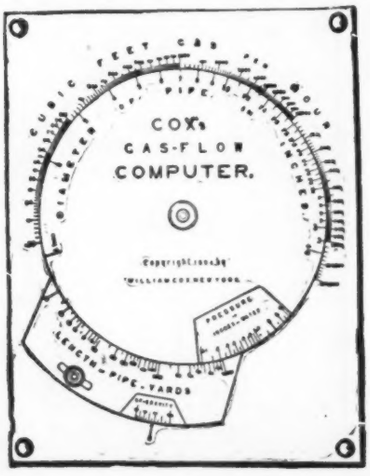

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